MINISTRY OF THE ENVIRONMENT SVT Environment 1997:10C

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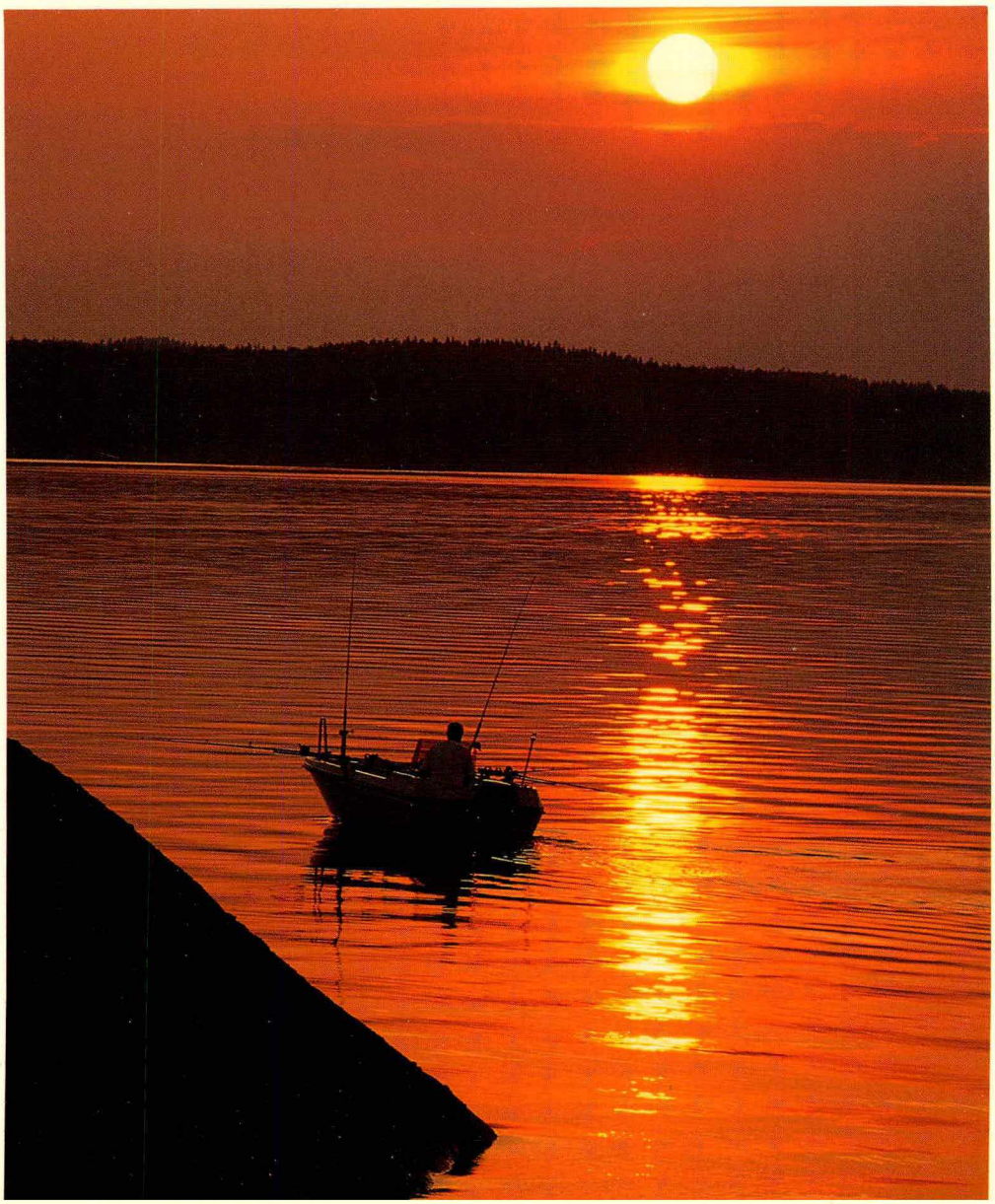
Finland's Natural Resources and the Environment 1997



YMPÄRISTÖMINISTERIÖ
MILJÖMINISTERIET
MINISTRY OF THE ENVIRONMENT

SVT

Ympäristö 1997:10C
Miljön
Environment

Tilastokeskus
Statistikcentralen
Statistics Finland

Finland's Natural Resources and the Environment 1997

Helsinki 1997

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SVT Suomen virallinen tilasto
Finlands officiella statistik
Official Statistics of Finland

Cover: Luontokuva-arkisto/Markus Laaksonen

Layout: Hilkka Lehikoinen

ISSN 0784-8455
= Environment
ISSN 1238-0261
ISBN 951-727-365-7

Helsinki 1997

Foreword

One of the main objectives set by the Government in its programme is to strengthen the principles of sustainable development in different sectors of society, especially in regard to the management of Finland's natural resources and the environment. The programme particularly emphasises the development of ecological accounting of both the national economy and the Government sector. This review on *Finland's Natural Resources and the Environment 1997* continues the practice first adopted by the Government in the budget for 1995 of assessing the state of the country's natural resources and the environment in drawing up its budget proposal. The next review shall be published in connection with the Government's budget proposal for 1999.

One of the items approved by the United Nations Conference on Environment and Development in Rio de Janeiro in 1992 was an extensive action plan for sustainable development (Agenda 21). Five years on, in June 1997, the world states reiterated their commitment to this plan at the Rio follow-up meeting in New York (UNGASS). It was also acknowledged that implementation of Agenda 21 must be intensified in order that the goal of a sustainable future can be attained. Finland has for its part committed itself to the objectives of the policy of sustainable development, aiming to reconcile in all fields of society and at all levels of decision-making the principles of ecological sustainability with a sustainable socio-economic development.

This review was compiled by a working group appointed by the Ministry of the Environment chaired by Mr. Markku Nurmi, Director General, from the Ministry of the Environment, assisted by Mr. Heikki Suorama, Special Advisor, and Pekka Pelkonen, Special Advisor, from the Ministry of Finance, Mr. Risto Timonen, Senior Inspector, from the Ministry of Agriculture and Forestry, Ms. Erja Fagerlund, Senior Inspector, from the Ministry of Trade and Industry, Ms. Johanna Haavisto, Researcher, from the Ministry of Transport and Communications, and Mr. Jarmo Muurman, Senior Inspector, and Ms. Pirkko Isoviita, Chief Forester, from the Ministry of the Environment. Acting as secretaries to the team were Mr. Jukka Hoffrén from Statistics Finland and Mr. Kimmo Silvo from the Finnish Environment Institute. The project was financed by the Ministry of the Environment.

Helsinki, September 1997

Ministry of the Environment

Pekka Haavisto
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Contents

1 The economy and the environment

Sustainable development

In its programme the Finnish Government has made clear its commitment to the principles of sustainable development: those principles shall be promoted into the new millennium in all fields of society, and particularly in the management of the country's natural resources and the environment. The programme specifies a number of policies and actions on natural resources, energy, agriculture, and transport that have a direct bearing on the environment and sustainable development. Some decisions have already been taken, others are now under preparation. Amongst the most important measures implemented are the amendments to environmental protection and forest legislation, which took effect as from the beginning of 1997. The changes will help to preserve the biodiversity in Finland.

The United Nations General Assembly Special Session (UNGASS) on sustainable development was convened in New York in summer 1997 at the highest political level. The purpose of this follow-up meeting was to review progress during the past five years in the implementation by governments and international organisations of the Rio decisions. The biggest challenge for sustainable development today is to change existing production and consumption patterns in industrial countries. UNGASS also decided that during 1998–2002, the UN Committee on Sustainable Development (CSD) shall focus in its work on fresh water, oceans, forests, and energy issues.

The European Union has been a major force in promoting the measures identified in Agenda 21, the action plan for sustainable development adopted in Rio. According to the fifth EU environmental programme, one of the Union's basic objectives is an ecologically sustainable development. Additionally, the EU wants to see a harmonisation of environmental and economic policies as well as environmental legislation in different Member States; the development and use of energy-conserving technologies; the development of renewable energy sources; improved environmental information management in business companies; internalisation of external costs for energy and transport; and the promotion of environmentally compatible cultivation methods. A close monitoring of external costs can help to achieve significant savings.

The EU programme also calls upon Member States to improve access to information on the environment in different sectors: this is crucially important for better integration of economic and environmental decision-making. The identification of quantitative parameters for sustainable development could help to reconcile activities in different areas. Although experts say that the EU has made progress in terms of reducing certain adverse impacts on the environment, these reductions are not yet sufficient to protect the state of the environment in Member States and to promote sustainable development. Environmental protection must be stepped up if the targets are to be met.

Instruments of environmental protection

The State has access to three different types of instruments for environmental protection, i.e. administrative, economic, and informational. In addition to restrictions based on legislation,

different countries have adopted a number of economic and voluntary instruments during the 1980s. These include taxes, marketable emission licences, eco-labelling, and voluntary agreements. The European Commission's ENVECO group has the following classification for these instruments:

1. Development of environment markets
   - eco-labelling
   - eco-auditing
   - environmental accounting
   - other environmental information

2. Loans/Subsidies for environmental investment
   - better energy economy
   - cleaner technology
   - employment and environmental protection

3. Taxation
   - renewable fuels
   - waste and emission taxes
   - VAT reliefs on environmental products

4. Voluntary agreements/consultations

5. Support for research and development
   - energy
   - cleaner production
   - environmentally compatible products
   - research on environmental business

6. Education

7. Sectoral policies
   - ecological farming
   - energy sector
   - transport
   - urban areas and regions
   - SMEs
   - major industries
   - environmental business

Finland applies a wide range of instruments for the economic regulation of environmental protection: these include taxes on goods with adverse effects on the environment, graded taxation based on environmental impacts, economic incentives, certain administrative and municipal fees, financial subsidies, and deposit schemes to encourage recycling. The most important economic instruments are tax-related.

The Government says in its programme that it plans to compensate for a significant part of the lowered level of labour taxation by increasing environmental taxation. The aim is a tax model which encourages people to conserve energy and to reduce environmental emissions. A key issue in the introduction of environmental taxes is the regulatory effect of the tax relative to its fiscal effect. The revenue from environmental taxes allows the State to lower other taxes without changing the overall tax returns. When the regulatory effect is not particularly strong, the environmental tax yields a steady revenue. The yield of an environmental tax with a strong regulatory effect will decline in the long term. Since heavy environmental taxes may adversely affect the international competitiveness of the industries that are affected most, a rapid shift in the direction of environmental taxation is not possible.

No country has as yet made a comprehensive shift towards environmental taxation, basically because the coverage of labour income taxation is several times the coverage of any conceivable system of environmental taxation. In addition, given the process of economic globalisation, a high level of environmental taxation would probably encourage businesses to relocate in third countries. This highlights the importance of international co-operation and the need for a broad economic approach. It is impossible to assess the im-

pacts of a change in the direction of taxation upon the national economy in general since those impacts depend upon a wide range of economic mechanisms.

The latest of the new environmental taxes is the waste tax, which is levied on all landfill waste with the exception of extractable land resources and biodegradable waste. The waste tax took effect at the beginning of September 1996 and is levied at a rate of FIM 90 per tonne. The tax is expected to yield FIM 350 million a year in revenue, with households accounting for about 20 per cent.

The latest recycling system was launched at the beginning of June 1996 to recycle used car tyres. The system is financed by a recycling fee included in the price of the tyre. Each year Finland accumulates a total of some 30 million kilograms of used tyres, of which almost 70 per cent used to end up as landfill. Deposit schemes for glass bottles and drink cans are also in use.

Table 1 lists the taxes and fees that have a clear regulatory impact. Not all of them are itemised in the national budget. Monies are collected separately into an oil pollution fund. Many of these taxes and fees have been imposed for reasons other than environmental protection. The environmentally-related taxes with the most marked regulatory effect are the surtax levied on alcoholic beverages and soft drinks, the environmental energy surtax, the oil waste tax, the water protection fee, the oil pollution control fee, and the waste tax. Special taxes levied on energy and transport are examined in more detail in chapters 3 and 4, respectively.

1. Environmentally-related State taxes and fees (FIM million)

	1993 R	1994 R	1995 R	1996 R	1997 B	1998 BP
Alcoholic beverages surtax (disposable drink-carton tax)	16	48	88	52	50	50
Soft drink surtax	19	16	15	9	9	9
Fertilizer tax	516	267	–	–	–	–
Pesticide tax	6	6	6	6	6	6
Electricity tax	656	56	–	–	–	–
Energy taxes, of which	8 404	9 815	11 628	12 714	14 100	15170
Carbon dioxide component	*1 005*	*1 140*	*1 488*	*1 375*	..	..
Energy component	–	*760*	*791*	*890*	..	..
Basic tax	*7 399*	*7 915*	*9 349*	*10 449*	..	..
Oil waste tax	21	19	21	20	20	20
Car and motorcycle tax	1 609	2 054	2 685	3 611	3 800	4 500
Charter flight tax	111	80	–	–	–	–
Water protection tax	2	2	3	3	2	3
Oil pollution control fee	34	31	34	29	34	34
Vehicle tax ("sticker tax")	–	618	1 046	1 110	1 070	1 140
Motor vehicle tax ("diesel tax")	885	844	668	929	870	900
Waste tax	–	–	–	41	300	200
Total	**12 279**	**13 856**	**16 194**	**18 524**	**20 261**	**22 032**

R = revenue B = budget BP = budget proposal – = not in use .. = data missing

Environmental protection in state administration

The Government can seek to improve the state of the environment not only by the economic and administrative mechanisms discussed above, but also by its own measures of environmental protection and an environmentally conscious purchasing policy. State administration plays a particularly important role in conducting and financing environmental R&D. Research into the environment is financed by the Academy of Finland, the Technology Development Centre, and the ministries operating in the environmental, energy, and natural resources sectors. The extensive environmental research carried out by universities is not included in the figures shown in Table 2.

Expenditure on environmental protection is mainly directed at improving and restoring the state of the environment. This expenditure consists chiefly of investment subsidies to industry and income transfers to municipalities. Nature conservation funds are set aside for the purchase and management of nature conservation areas; these funds are examined in closer detail in the chapter on Natural resources. The most significant State environmental protection expenditure item since 1995 has been the environmental support for

2. State expenditure on environmental protection (FIM million)

	1992	1993	1994	1995	1996	1997	1998**)
Environmental administration	392	355	378	430	455	469	492
Central government	*108*	*95*	*128*	*127*	*136*	*139*	*154*
Local government	*283*	*250*	*250*	*303*	*319*	*330*	*338*
Cooperation with nearby areas	*86*	*55*	*57*	*57*	*57*	*62*	*66*
Nordic environmental financing company	8	9	9	8	7	7	7
Research and development*)	444	453	492	533	528	551	567
Environmental protection and management[1)]	*209*	*202*	*229*	*190*	*202*	*199*	*200*
Use and management of natural resources[2)]	*98*	*89*	*83*	*119*	*128*	*141*	*138*
Development of environmental technology[3)]	*110*	*136*	*149*	*193*	*169*	*184*	*210*
Other environmental research[4)]	*27*	*27*	*29*	*31*	*29*	*27*	*28*
Grants to non-governmental environmental organisations	6	6	6	6	6	6	6
Environmental protection	92	119	152	85	119	189	175
Air protection and waste management	*25*	*38*	*47*	*45*	*41*	*27*	*9*
Water protection	*24*	*25*	*22*	*8*	*33*	*57*	*58*
Environmental management and decontamination	*43*	*55*	*83*	*32*	*45*	*106*	*109*
Environmental subsidies for silviculture	235	264	366	312	306	479	549
Energy conservation promotion	8	6	10	6	8	8	8
Environmental protection of transport*)	..	..	136	147	188	211	219
Railway transport	..	..	..	..	79	93	..
Subsidies for manure pit investments	47	55	84	–	65	80	60
Environmental subsidy for agriculture	–	–	–	1 420	1 570	1 577	1 690
Basic subsidy	–	–	–	1 330	1 367	1 367	1 384
Special subsidy	–	–	–	90	203	210	306
Nature conservation	–	–	–	–	10	15	15
Total	**1 317**	**1 322**	**1 689**	**3 004**	**3 398**	**3 746**	**3 853**

– = not in use .. = data missing *) = estimate **) = forecast

1) Environmental administration and Academy of Finland
2) Agriculture and forestry administration
3) Technical research
4) Other administrative sectors

agriculture. The distribution and use of this support is examined more closely in the chapter on Natural resources.

Environmental protection by municipalities

The Finnish Association of Local Authorities adopted in March 1997 an action plan for sustainable development extending to the year 2005. Local authorities can significantly contribute to sustainable development by way of land use planning, infrastructure development, education, and so on. Local agenda projects for sustainable development are currently underway in around 135 municipalities, which represent about 60 per cent of the population. The number of municipalities involved in local agenda projects is rising all the time.

In 1996 a total of some 700 people were engaged in environmental protection on a full-time or part-time basis in the country's 455 municipalities and municipal federations. 172 municipalities have no hired experts on environmental protection.

Each year, municipalities and municipal federations spend considerable sums of money on environmental protection. Preliminary figures for 1996 indicate that municipalities and municipal federations spent a total of almost FIM 3.1 billion on environmental protection, of which over one billion consisted of investments and two billion of operating expenditure. Almost half of the expenditure, 43 per cent went to sewerage, 30 per cent to waste water treatment, and almost 15 per cent to waste management. Table 3 shows the expenditure by municipalities, municipal federations, and municipal agencies on environmental protection.

3. Municipal expenditures on environmental protection (FIM million)

	1993	1994	1995	1996*)
Waste management				
Investments	51	98	86	53
Operating expenditure	415	409	397	283
Water supply				
Waste water treatment				
Investments	385	223	203	250
Operating expenditure	849	768	760	668
Sewerage				
Investments	555	510	576	708
Operating expenditure	1 038	919	910	780
Energy production				
Air protection				
Investments	655	169	34	6
Operating expenditure	143	156	158	73
Environmental management				
Investments	16	29	19	35
Operating expenditure	188	188	189	195
Total				
Investments	1 007	1 083	918	1 052
Operating expenditure	2 489	2 315	2 414	1 999

*) = preliminary

The bulk of the municipalities' environmental protection expenditure goes to sewerage and waste water treatment. The cost of waste management, sewerage, and waste water treatment is for the most part covered by user-fees. Investments in these projects have, however, to some extent been financed out of the national budget. The expenditure on environmental management is financed out of the municipalities' tax revenue and State income transfers.

Trends in environmental health

Improving housing conditions, better nutrition, rising standards of hygiene, and comprehensive vaccination programmes have contributed to a steady improvement of the health of the nation throughout the 20th century. At the same time, however, there has been a clear increase in the prevalence of asthma and different types of allergies. In the 1960s, around one per cent of the adult population reported having asthma, by 1995 the figure (according to research by the Social Insurance Institution) was about four per cent. It is not clear what exactly lies behind the increased prevalence of allergic diseases. Risk factors for the development of allergic disorders include smoking, indoor air quality, and exposure to chemicals. Experts believe that the risk for asthma is increased by pollutants in outdoor air, particularly emissions from road traffic.

Around 40 per cent of the population in Finland is exposed to pollution in outdoor air, which is thought to be responsible for exacerbating the asthma symptoms of some 30 000 sufferers and for 30 000–40 000 respiratory infections in children each year. Exposure to environmental pollution is nevertheless at a low level in Finland in comparison with the industrial centres of Europe. No changes are expected in this respect in the near future.

Finland's national programme for environmental health makes a distinction between the following categories of environmental health:

1. The areas in which the high standards already achieved shall be maintained:

   - quality of household water
   - safety of foodstuffs and health
   - radiation safety

2. Environmental health hazards which require significant further steps for better control:

   - quality of indoor air
   - quality of outdoor air
   - noise
   - accidents
   - psychological and social health risks in the environment

3. Other promotion of environmental health:

   - halting climate change and the thinning of the ozone layer
   - incorporation of health considerations in urban planning and development
   - grassroots participation in the promotion of environmental health
   - research and product development related to environmental health

In 1997 the Academy of Finland launched a three-year research programme in which the aim is to identify the risk factors related to environmental health. The project has a budget of FIM 30 million.

4. Asthma sufferers as a proportion of the adult population in Finland (%)

	Men	Women
1964	0.9	1.0
1968	1.1	0.9
1976	1.2	1.2
1987	1.8	2.3
1995	3.8	4.7

2 Industry

Steering mechanisms

Finland's success on the world markets and its rise among the richest countries of the world is largely attributable to the high level of expertise and know-how in the country. Finland is a land of major industrial companies: the proportion of the labour force working for major corporations is higher than in Europe on average. During the 1990s industrial production has increased its share of GDP to 31.2 per cent at the same time as the figures for services, building and construction, and agriculture have declined. In 1996 the metal industry accounted for 42.5 per cent of total industrial production, the figures for the forest industry and the chemical industry were 16.4 and 9.6 per cent, respectively. The metal industry accounts for around 45 per cent of Finland's exports, the forest industry for 36 per cent, and the chemical industry for 10 per cent.

The EU IPPC-directive on harmonised emission prevention and control, adopted in 1996, will take effect in 1999. Finland is currently preparing its environmental protection law as required by this directive. The directive underlines the responsibility of companies to use the best technology available in their processes and operations. In Finland, this requirement of the "best technology available" has been included in legislation on water and air pollution control as well as in the laws on waste management and marine protection. During the 1990s, new legislation on environmental impact assessment and on environmental licensing procedures (still under preparation) have brought important improvements to the assessment and management of the environmental impacts of industrial operations.

Total expenditure on environmental protection by industry has remained unchanged in recent years in spite of a reduced level of investment in air protection by energy production following the completion of earlier major projects. In 1992 and 1993 environmental protection accounted for around ten per cent of total investments in industry, in 1994 the figure was less than six per cent and in 1995 close on seven per cent. In 1995, 29 per cent of environmental investments went towards air protection, 60 per cent towards water protection, and nine per cent towards waste management and soil and groundwater protection.

5. Environmental protection expenditure by industry (FIM million)

	1992	1993	1994	1995
Energy production	819	939	418	276
Forest industry	990	940	932	1 371
Chemical and mineral industry	497	642	428	602
Metal industry	530	332	449	564
Other industries	60	2 743	285	300
Total	**3 196**	**3 124**	**2 512**	**3 113**
of which				
Investments	1 841	1 614	1 022	1 538
Operating expenditure	1 355	1 510	1 491	1 575

Environmental management

During the 1990s environmental protection in industry has been moving towards management by information and towards the introduction of environmental management systems. As far as industry is concerned sustain-

able development consists in more efficient use of natural resources and energy as well as in reducing emissions. Apart from helping companies achieve these objectives, an environmental management system can help to cut costs.

Since autumn 1995 companies have had the option of applying the global ISO 14001 standard, which replaces national environmental management systems. Another relevant system is the environmental management and audit scheme EMAS, a voluntary programme for industrial companies within the EU. The first Finnish companies joined the EMAS system in spring 1996. According to the EU Commission, the ISO system is compatible with EMAS given certain additions, such as an environmental reporting.

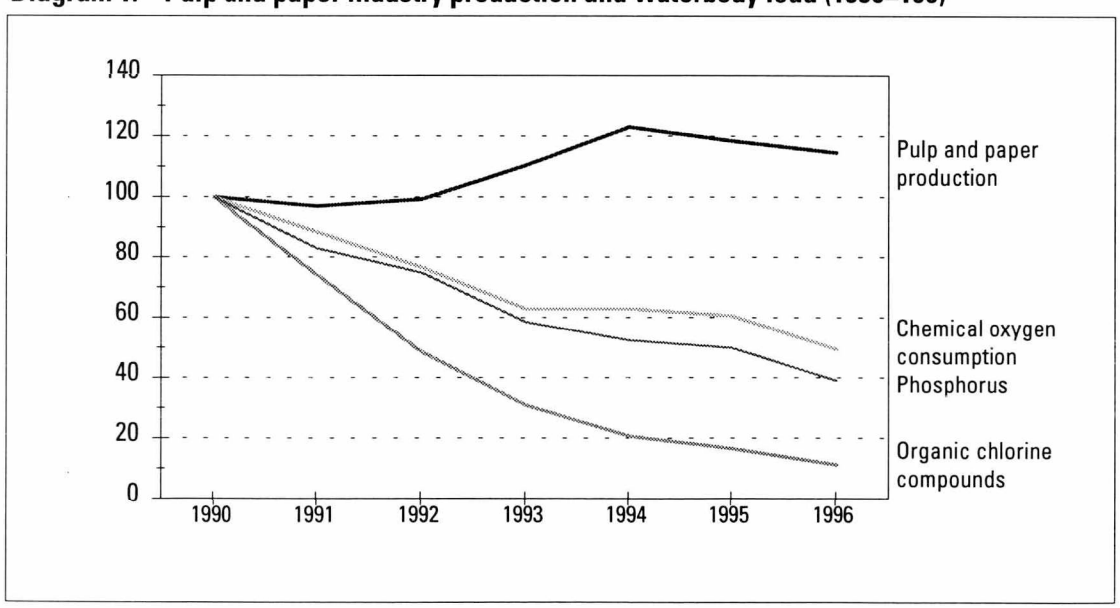
Companies in the forest and the chemical industry have been particularly interested in the introduction of environmental management systems. Certification requires a continuous effort to raise standards of environmental protection. In addition, EMAS requires that participating companies regularly produce for each registered unit a detailed environmental report for the general public and customers. These systems are conducive to reliable environmental management and lend credibility to companies' efforts in environmental protection. To support and encourage this development, the Ministry of Trade and Industry and the Ministry of the Environment will be arranging a competition in autumn 1997 for the best environmental report.

Forest industry

The production of paper and other forest industry products has been at record-high levels in recent years. At the same time the environmental impact of the industry relative to production volumes has been significantly reduced.

The principal emissions by the forest industry are down to one-tenth of the figures recorded in 1980. The forest industry has invested particularly in the development of closed water circuits, the development of production processes and bleaching methods, and better pu-

Diagram 1. Pulp and paper industry production and waterbody load (1990=100)



rification of effluent. For example, the use of elemental chlorine for bleaching purposes has been discontinued. The emphasis in air protection has been on the treatment of odorous gases and on reducing emissions of nitrogen oxides. In addition, broke recovery and landfill maintenance have been intensified.

In recent years the investments in environmental protection by the forest industry have concentrated increasingly on the development of production processes. Almost 65 per cent of the industry's environmental investment is aimed at improving production technology, the remaining 35 per cent goes towards traditional projects aimed at reducing emission loads. Water protection projects such as the closure of water circuits, the development of bleaching methods, and the purification of effluent occupy an important place: 75 per cent of the investments by the forest industry are in water protection. Almost all forest industry companies are working to develop environmental management systems and to improve their standards of environmental protection.

The forest industry boasts a high rate of waste utilisation: over 95 per cent of various types of waste wood from pulp and paper mills is used for energy and pulp production. Wood waste from the sawmill and board industry is recycled primarily as a raw material and for energy production in pulp mills. Waste paper and board is also recovered and recycled. Biological waste water treatment generates large amounts of sludge, roughly half of which is used for energy production. Steps are needed to further intensify the treatment and recycling of sludge, logs, deinking waste, and lye deposit.

In 1996, Finland produced a total of 10.4 million tonnes of paper and board, of which 90 per cent was exported. A total of 563 000 tonnes of paper was recovered through recycling, representing 60 per cent of the end-consumption of paper and board in Finland. This recycling rate is high when compared with most Central European countries. Some waste paper was also imported for the production of recycled fibre. Given the long distances and sparse population in Finland, which translate into high transport costs, there is only limited

Diagram 2. Pulp and paper industry production and atmospheric emissions (1990=100)

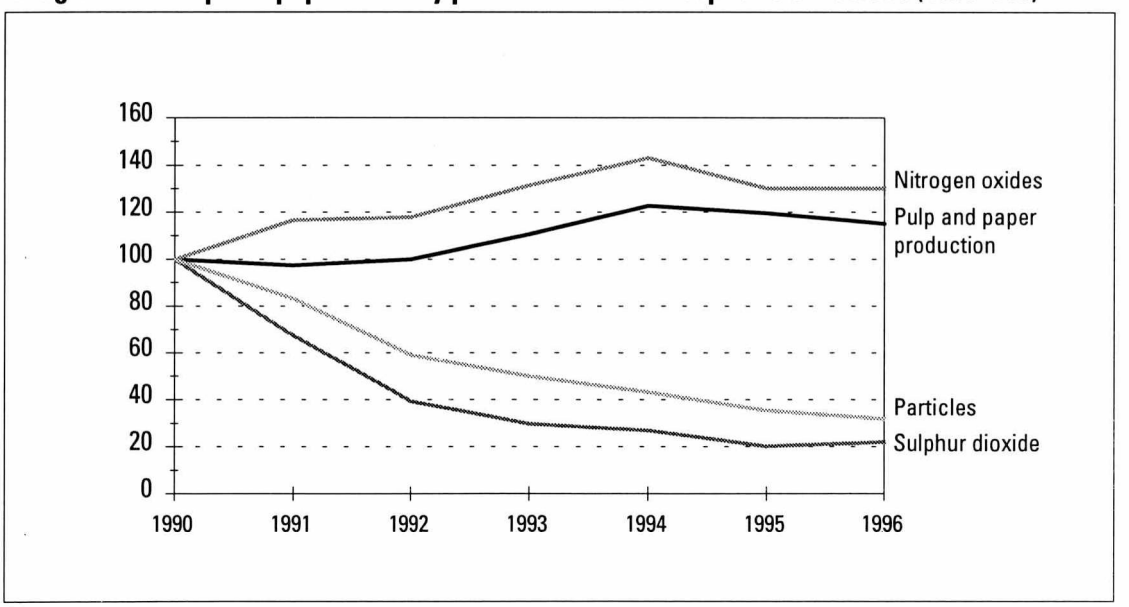
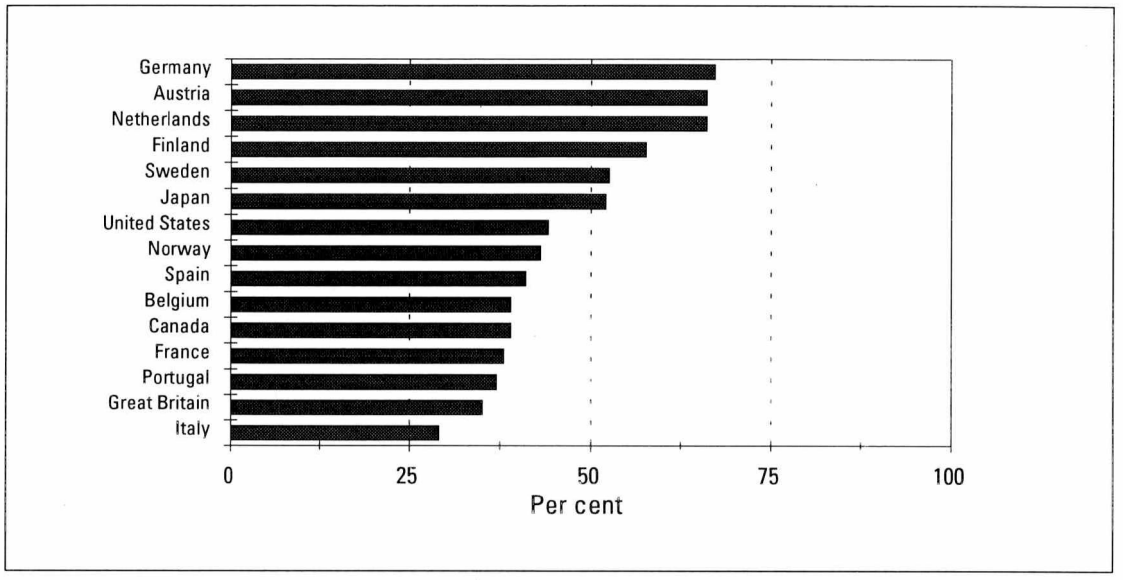


Diagram 3. Recovery of waste paper in different countries 1995



scope for any further, cost-effective expansion of recycling. It is, however, possible to raise the recycling rate by improving the quality of waste paper, but this will require consumer awareness campaigns to promote better sorting.

Chemical industry

The chemical industry has taken important voluntary steps to raise the standards of its environmental protection within the context of the international Responsible Care programme. In Finland, over 50 companies have committed themselves to the programme. In terms of output tonnage, these companies represent over 80 per cent of the industry. All in all, there are around 300 companies in the chemical industry in Finland, of which 61 per cent are small operations with less than 50 staff.

The companies involved in the programme have managed to reduce the chemical oxygen demand of water, sulphur dioxide emissions, and atmospheric emissions of volatile organic compounds.

In 1996, 78 per cent of the companies committed to the Responsible Care programme had obtained certificates in accordance with some environmental or quality standard. Half of the ISO 14001 environmental systems certified in Finland have been set up in companies committed to this programme.

The chemical industry has managed to reduce some of its emissions into the atmosphere and waterbodies. In addition, waste volumes have decreased since 1994. In 1996, energy consumption in the chemical industry was down by five per cent; in 1997 it is expected to rise by 1.3 per cent.

6. Chemical industry waterbody load (tonnes)

	1991	1993	1995
Phosphorus	25	20	20
Nitrogen	540	545	464

7. Emissions from the oil refining and the petrochemical industry (tonnes)

	1993	1996
Volatile hydrocarbons	8 900	3 450
Nitrogen oxides	4 920	4 452
Sulphur dioxide	6 724	6 300
Oil spills	11	4
Hazardous waste	1 080	1 380

Metal industry

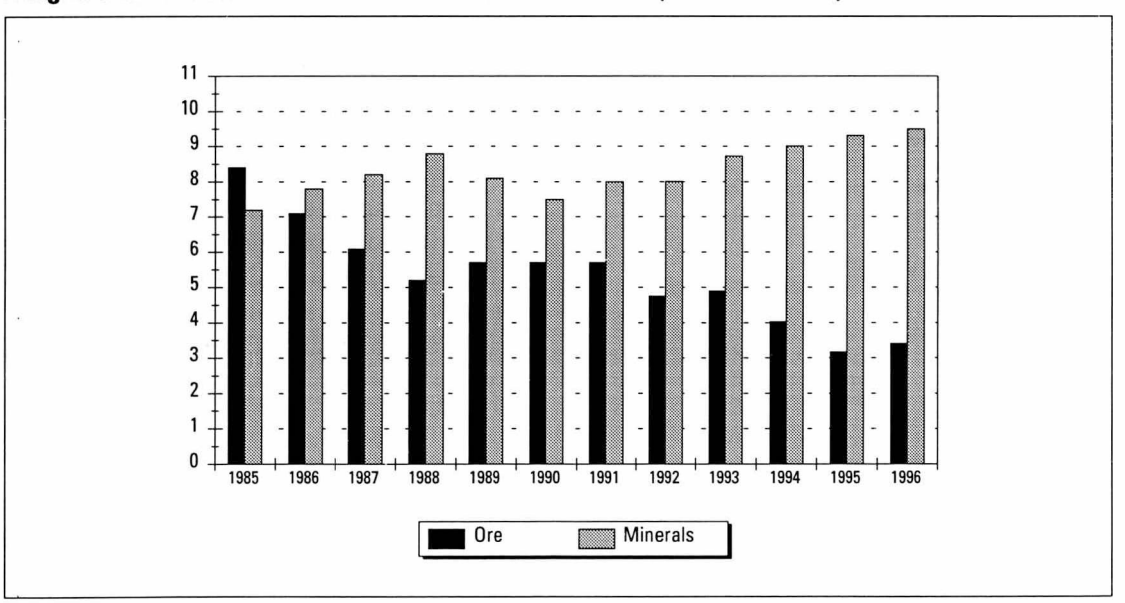
Finland's metal industry played a major role alongside the forest industry in the process of industrialisation after World War II. Today, the country's orebody is relatively scarce compared with the demand in industry. Finland's ore deposits are becoming rapidly depleted. Since the metal industry in Finland is highly sophisticated and competitive, metal refining will probably continue for a long time, although it will have to rely on imported raw materials. In the future, Finland's metal industry will probably rely for the most part on foreign raw materials and recycling.

Most of the steel produced in Finland is made from iron concentrates imported from Sweden and Russia. Steel is also made from scrap iron. In 1994 the metal industry imported 3.6 million tonnes of metallic minerals and 1.1 million tonnes of rolled products and scrap metal.

Production volumes in Finnish mines have sharply declined during the 1990s. In 1996 there were 45 mines in operation. Eight of these were ore mines, 19 limestone mines, 12 mineral mines and six were other mines, mainly producing aggregates for rock wool and concrete production. Production from the ore mines in 1996 totalled 3.4 million tonnes, with a gross value of approximately FIM 600 million. The most important metals are chrome, zinc, nickel, copper, and gold. Production from limestone mines totalled 3.4 million tonnes.

Environmental investments by the Finnish metal industry still consist primarily of traditional purification technology to reduce emission levels. In value terms, environmental in-

Diagram 4. Ore and minerals excavation in 1985–1996 (million tonnes)



vestment by the metal industry has in recent years been at the same level as in the chemical industry. In 1995 the metal industry accounted for 16 per cent of total industrial investment in environmental protection.

The main sources of environmental pollution in the metal industry are the production of metals and metal products. In 1995 the industry's investments in air pollution control focused on the recovery of particle and dust emissions. In addition, much attention has been given to improving waste management. Operating and maintenance expenditure on water protection has also increased in the metal industry.

The focal areas of environmental protection in the metal industry are to close off material flows, to reduce the adverse effects from surface dressing and painting, to reduce the consumption of materials, and to improve recycling. This will require a widespread adoption of environmental management systems and related life-cycle analyses.

8. Emissions from metal production

	1990	1995
Production volume	**100.0**	**130.7**
Emissions in the atmosphere (thousand tonnes)		
Sulphur dioxide	22.9	8.5
Nitrogen oxides	3.6	3.6
Emissions in the waterbodies (thousand tonnes)		
Nitrogen	691.0	424.0
Chrome	2.0	3.5
Nickel	20.2	11.6
Copper	6.9	8.3
Zinc	17.3	10.7

Waste management

Each year Finland produces around 15.4 million tonnes of industrial waste, which represents almost 18 per cent of the total volume of waste. Industry recycles 59 per cent of its own waste, 2.5 million tonnes is consigned to landfill. Households generate a total of almost 0.9 million tonnes of waste; biodegradable waste accounts for about 35 per cent, paper for over 30 per cent, and plastic for about eight per cent of this.

Energy production is the primary use of recycled industrial waste. Industrial waste is also used as a raw material and earth fill. The highest recovery rate for industrial waste is recorded for scrap metal, the recycling of which is economically viable. In 1992 industry produced a total of some 500 000 tonnes of scrap metals, of which 58 per cent was recycled. Around 20 per cent of the scrap metal produced by households was recycled. Industry is responsible for producing the majority of hazardous waste in Finland. About one-third of this waste is recycled.

A new law which came into force at the beginning of 1994 to minimise the amount of waste produced in the country, places companies under strict obligation to maintain records of their wastes. A new waste tax was introduced in autumn 1996. In the near future intensification of waste cycling will also be required by the EU packaging directive, which will make the recovery of packing materials compulsory by the year 2001. In Finland annual consumption of packagings amounts to around 870 000 tonnes, of which an estimated 43 per cent is recycled.

3 Energy

Use of energy

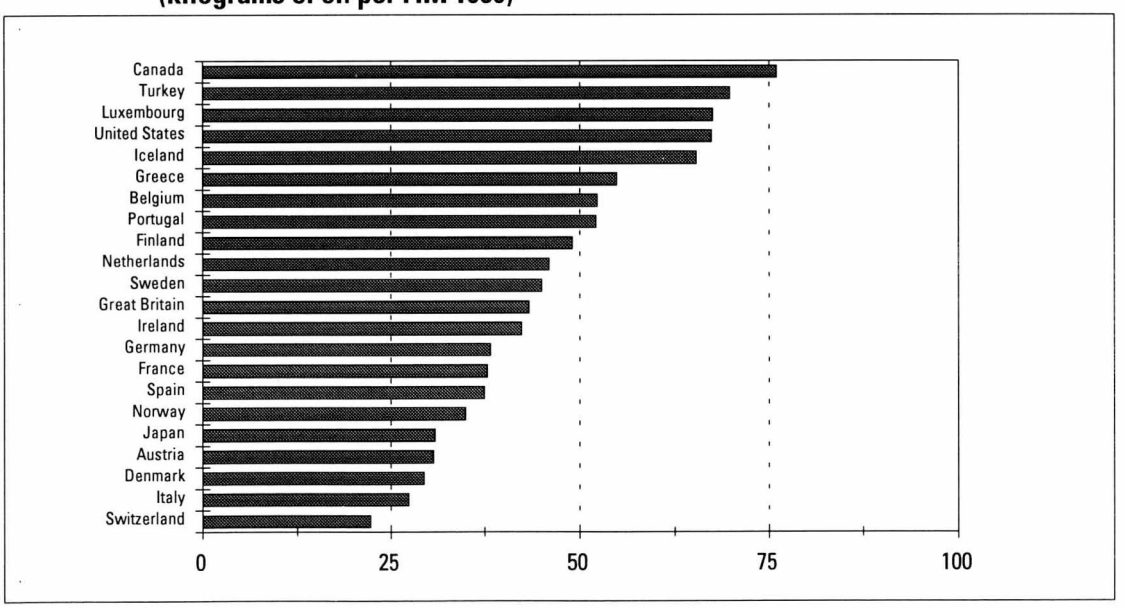
Finland has a high level of energy consumption per capita. This is due to the country's northern location and consequent need for heating energy, its high degree of industrialisation, and long transport distances owing to the fact that the country is sparsely populated. The market areas of the export industries are also far away. Energy production in Finland is highly efficient; one contributing factor is that thermal energy and electricity are produced in the same power plants.

Finland's total energy consumption in 1996 was 32 Mtoe. Industry accounted for 45 per cent, heating for 23 per cent, transport for 13 per cent, while others accounted for the remaining 19 per cent. The structure of energy consumption has remained unchanged for the past ten years. Fossil fuels account for 46 per cent, nuclear power for 14 per cent, and imported electricity for seven per cent of the total use of energy. Domestic energy sources such as hydropower, peat, and wood account for one-third of consumption. In 1996 electricity consumption in Finland totalled 70 TWh, of which industry accounted for 37 TWh. The share of coal and peat in energy production increased by over one-quarter. Nuclear power was used to produce 18.7 TWh of electricity (26.6 per cent of total electricity consumption), hydropower generated 11.7 TWh (19 per cent).

9. Total energy consumption 1996

	Mtoe	%
Industry	14.6	45
Heating	7.2	23
Transport	4.1	13
Other	6.1	19
Total	**32.0**	**100**

Diagram 5. Total energy consumption per GDP unit in certain countries in 1994 (kilograms of oil per FIM 1000)



In its report to Parliament in June 1997 the Government says the country's energy policy is to bring the growth of energy consumption to a halt over the next 10–15 years and to step up the structural change of the energy economy. The targets set out in the report mean that Finland shall be moving increasingly from the use of fossil fuels towards renewable and low-emission energy sources. The Government wants to see a sharp increase in the use of natural gas, increased production and use of energy wood, and effective steps for energy conservation. These goals have been motivated by growing concerns about Finland's rising carbon dioxide emissions. However, all these steps shall be implemented in such a way that they do not jeopardise economic growth or impose unnecessary restrictions on consumers.

In particular, the Government considers it important that the economic steering mechanisms (and most importantly taxation) are applied at least to the extent laid down by the European Union. According to the Government report Taxation shall nevertheless be developed with a view to securing access in industry to energy at an internationally competitive price. National energy taxation shall retain its existing basic structure, without undermining the position of industries dependent upon the price of energy vis-à-vis their most important competitors. The natural gas option requires not only national measures but also significant international decisions and active lobbying on Finland's part to influence those decisions. If Finland is to rely to a much greater extent on natural gas than is the case today, assurances of guaranteed access must be obtained within the next few years. The Government shall for its part try to make sure that all investment decisions relating to Finland's membership of the European gas network will be made by the year 1999.

A significant increase in the use of natural gas is called for so that Finland can meet its international commitments to reducing greenhouse gas emissions without compromising its economic and employment objectives. Given the stringency of those commitments, according to the report, there must exist a preparedness to consider increasing the share of other forms of energy production which meet the relevant economic, employment, and environmental criteria, such as nuclear power. This applies particularly to a situation where natural gas is not available in sufficient amounts to compensate for the coal capacity.

The report also highlights the importance of increasing the use of renewable energy sources. The use of bioenergy, wind energy, and other forms of renewable energy can be stepped up by investment in long-term development programmes, by making available funding for projects aimed at upgrading new technology into commercially viable products, and by taxation that ensures the competitiveness of these energy sources. As far as wood is concerned the Government's target is to increase its use in energy production so that wood will become a significant fuel in district heating centres and heating plants, particularly in those areas where natural gas is not available.

Greenhouse gases

According to estimates by an international panel of experts, the mean temperature of the earth is expected to rise some four degrees by the year 2100, unless emissions of greenhouse gases can be reduced. The signatories to the UN Framework Convention of Climate Change at the Conference on Environment and Development in Rio de Janeiro in 1992 committed themselves to stabilising greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous interference with the climate system. At the initial stage the aim is to halt the further increase in

10. Finland's greenhouse gas emissions (million equivalent tonnes of carbon dioxide)

	1995	2000f	2010f
Carbon dioxide	56.0	58–60	56–71
Methane	5.1	4.7	4.0
Nitrous oxide	5.8	6.4	7.7
Nitrogen oxides	10.4	9.0	8.0
Carbon monoxide	1.3	1.2	0.9
Hydrocarbons	2.0	1.7	1.2
Total	**80.6**	**81–83**	**78–93**

f = forecast

11. Greenhouse gas in the EU countries according to the EEA and reduction targets by the year 2010

	Million Equivalent CO_2 tonnes	Reduction target
Luxembourg	14	–30 %
Germany	1 199	–25 %
Danmark	64	–25 %
Austria	73	–25 %
Belgium	136	–10 %
Netherlands	192	–10 %
Great Britain	711	–10 %
Italy	554	–7 %
France	482	0 %
Finland	**66**	**0 %**
Sweden	67	+5 %
Ireland	56	+15 %
Spain	304	+17 %
Greece	96	+30 %
Portugal	53	+40 %

greenhouse gas emissions by the year 2000 and later to regain the 1990 level. The international community will be convening in Kioto in December 1997 to agree on the reduction of greenhouse gas emissions.

As part of the process which started in Rio, the EU Member States agreed in spring 1997 on a joint target that would be set for the climate convention protocol negotiations: industrial countries should reduce their emissions by 15 per cent from the 1990 level by the year 2010. Steps taken by and within the Member States themselves shall account for 60–70 per cent of the targeted reduction, 30–40 per cent will require joint efforts such as a common policy line in norms, rules, and energy taxation. In quantitative terms a key role is played by Germany, which can achieve a large part of this reduction by closing down and upgrading its outdated plants in former East Germany. Finland's carbon dioxide emissions reached a record-high level in 1996. This was due to reduced electricity imports and increased exports to other Nordic countries, which increased energy production based on coal.

Diagram 6. Carbon dioxide emissions from fossil fuels and peat (million tonnes)

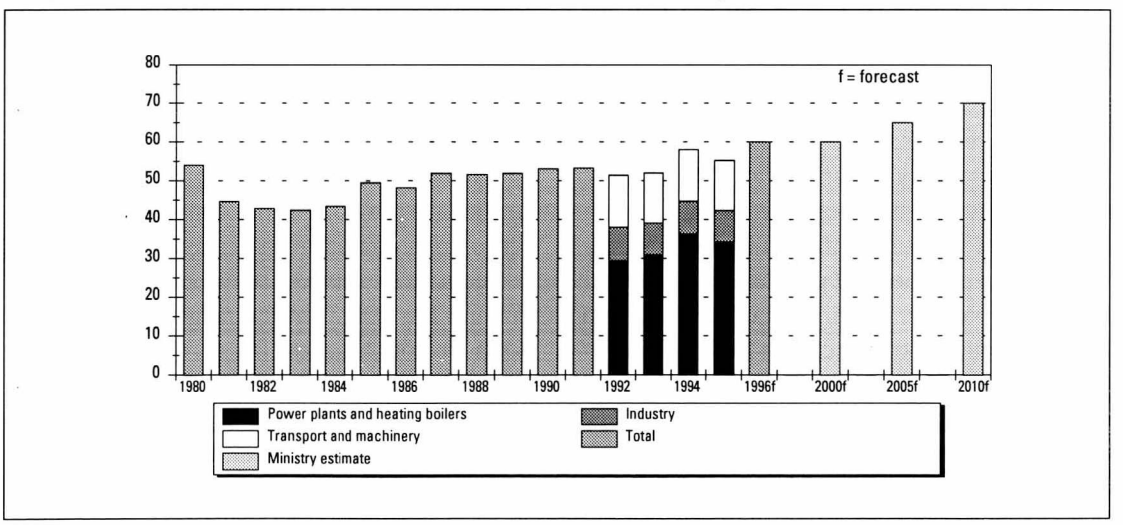
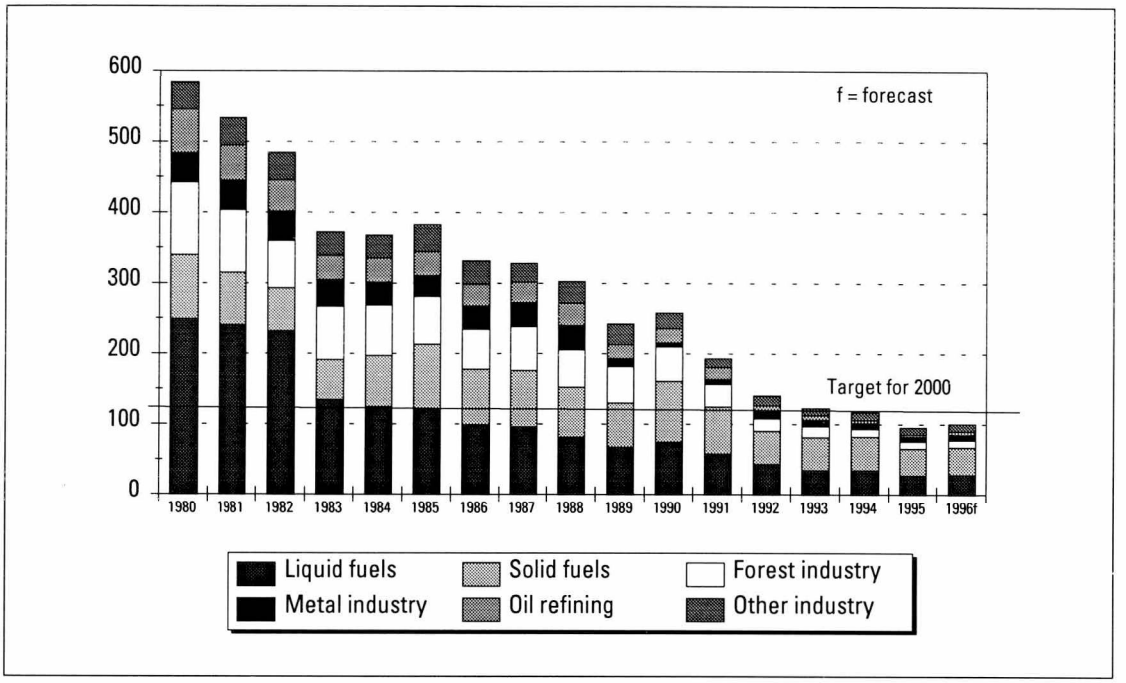


Diagram 7. Finland's sulphur emissions and target for reduction (thousand tonnes of sulphur dioxide)



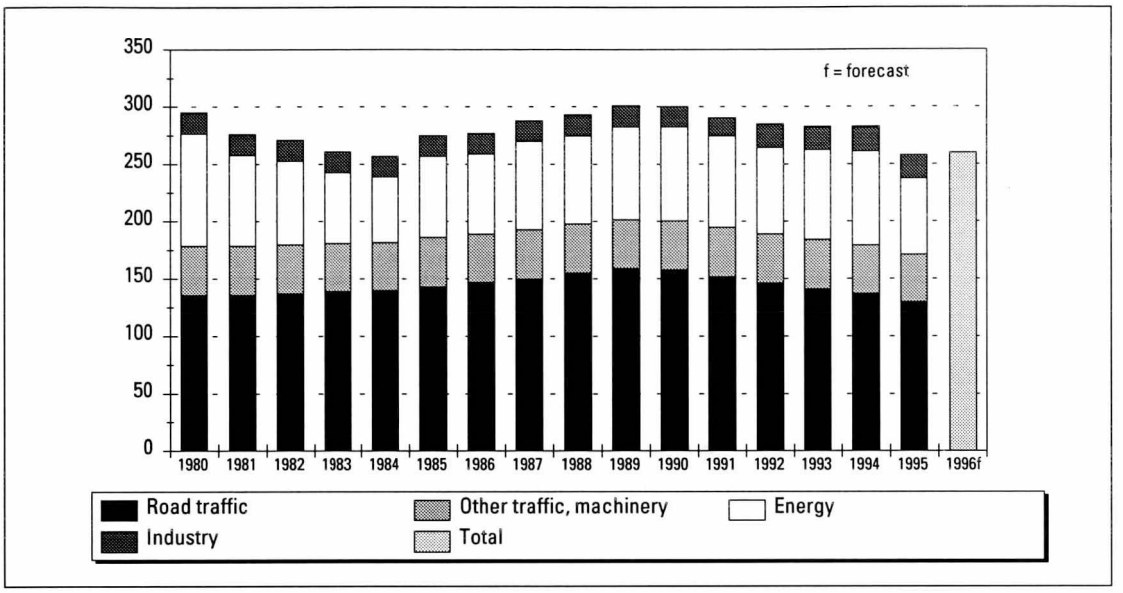
Sulphur dioxide emissions

Finland's sulphur dioxide emissions in 1995 totalled 95 700 tonnes, or 16 per cent of the figure for 1980. A number of factors have contributed to the lowered level of emissions: structural changes in energy production, the reduced use of heavy fuel oil, the reduced sulphur content of fuels, and advances in process technology. Finland's sulphur dioxide emissions relative to GDP are about one-third lower than the average for European OECD members. Electricity and heating energy production account for 28 per cent of the emissions, industry for 37 per cent. About 12 per cent of the sulphur dioxide deposition in Finland originates from domestic sources; 68 per cent of Finland's emissions drift outside the country. Finland achieved the targets set out in the second international sulphur protocol in Oslo for the year 2000 well ahead of schedule in 1994.

Nitrogen oxide emissions

Finland's total nitrogen oxide emissions in 1995 were around 258 000 tonnes, which is 13 per cent less than in 1980 and roughly the same as in 1985. About two-thirds of these emissions come from traffic. Electricity and heating energy production accounted for about one-fifth. Measured against GDP, the level of nitrogen oxide emissions in Finland is comparatively high, about 70 per cent higher than in European OECD countries on average. Around 16 per cent of the deposition of nitrogen oxides comes from domestic sources, 81 per cent drift outside the country's borders. Finland has achieved the target set out in the Sofia Protocol, according to which emission levels should be stabilised at the 1987 level by 1994. It seems likely that the EU target of a 30 per cent reduction in emissions for major combustion plants shall also be achieved.

Diagram 8. Finland's nitrogen oxide emissions and targets for their reduction (thousand tonnes)



NB. Emission calculation methods have changed and therefore the figures for 1992–1995 cannot be compared with earlier data.

12. Sulphur dioxide and nitrogen oxide emissions in the EU countries in 1994 according to EEA (thousand tonnes)

	SO_2	NO_x
Germany	2 995	2 210
Great Britain	2 719	2 422
Spain	2 061	1 223
Italy	1 437	2 157
France	1 013	1 682
Greece	556	357
Belgium	253	345
Portugal	272	254
Ireland	177	117
Danmark	155	272
Netherlands	154	542
Finland	**112**	**282**
Sweden	97	372
Austria	74	177
Luxembourg	13	23

Acidification

In Finland environmental acidification affects the soil and water of the most sensitive areas where the loads are highest. Acid deposition has caused damage to numerous fish populations and there is evidence of damage in around 2 000 lakes in southern and central Finland. During the past few years there have been signs of some recovery, however. The sulphate concentration of lakes in southern and central Finland is falling, and there has been a significant improvement in the acid resistance of lakes during the past ten years. Nonetheless, deposition exceeding the critical load is still expected to occur in certain parts of Finland up to the year 2000. The European Union is currently preparing its own programme for the prevention of acidification.

Groundwater pH values have dropped to some extent in many places around the country. The buffer capacity of well water has also declined. However, it does not seem that there is any real risk of a large-scale acidification of groundwater sources in Finland, nor does acidification represent a major threat to the welfare of our forests, at least in the near future. The situation may change in the long term unless deposition levels are reduced to the critical load in the whole country.

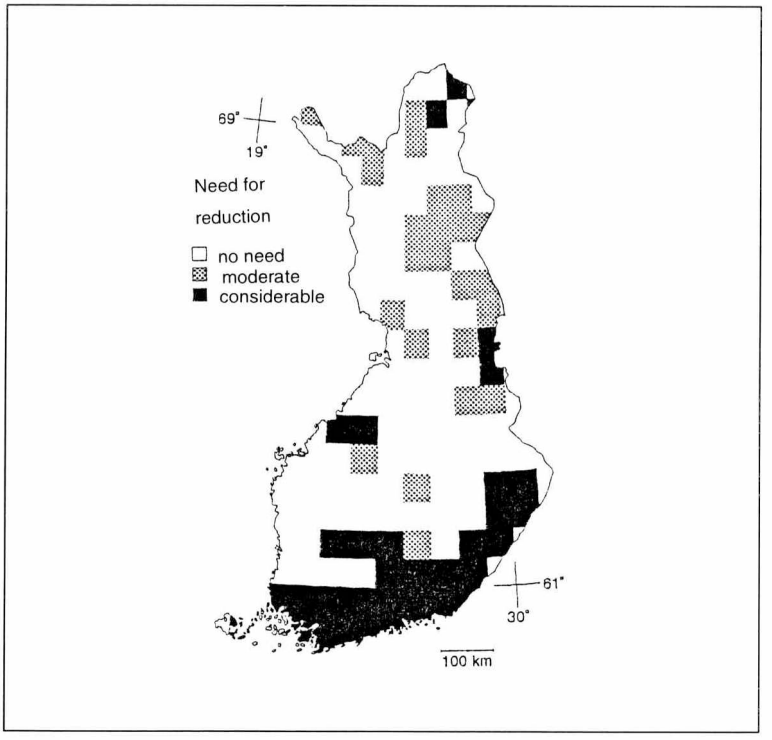
13. Origin of acid deposition in Finland 1995 (per cent)

	Sulphur	Nitrogen
Finland	12	16
EU and EEA	18	44
Eastern Europe	12	7
Baltic states	7	4
Russia etc.	21	8
Other countries	31	21
Total	**100**	**100**

14. Emissions of Finnish origin to other countries 1995 (per cent)

	Sulphur	Nitrogen
Finland	32	19
EU and EEA	7	9
Eastern Europe	1	3
Baltic states	4	4
Russia etc.	31	44
Other countries	26	23
Total	**100**	**100**

Diagram 9. The need to reduce the acid deposition in 1995: Finnish Environment Institute's estimate based on critical load



Sustainable energy supply

Sustainable development means ensuring that energy production is safe, efficient, and economical and that energy consumption is adjusted to the environment's bearing capacity. In particular, the use of renewable energy sources should be promoted and the efficiency of energy use improved.

The European Union has devoted considerable attention during the 1990s to renewable

energy sources. In late 1996 the EU issued its Green Paper for the promotion of the use of renewable energy sources. The target set out in this document is to double the share of renewable energy sources from 6 to 12 per cent by the year 2010. The concrete objectives and measures for the attainment of this target shall be published in the EU's White Paper on a renewable energy strategy during 1997.

The EU's ALTENER research programme on renewable energy sources was started up in 1993 and will be completed during 1997. The project has a budget of ECU 40 million. The aim of the programme has been to promote the adoption of renewable energy sources and trade in related equipment and technology. According to a survey carried out within the ALTENER project in 1994, it is possible to satisfy 13 per cent of the Union's energy need by renewable energy sources by the year 2010; by the year 2020 it is estimated that the figure could be over 20 per cent. Preparations are now underway to launch ALTENER II to continue this project.

In practice the biggest obstacle to the increased use of renewable energy, according to the Green Paper, is presented by the high costs compared with traditional energy sources (when external costs are not taken into account). Whether countries can succeed in the promotion of renewable energy depends largely on decisions taken in foreign, economic, regional, and agricultural policy.

According to EU's calculation methods in Finland water and hydropower account for over 18 per cent of total energy production, which is one of the highest figures in the European Union. However, there are still vast untapped energy resources in Finland's forests, bogs, and fields. For example, the total area prepared for fuel peat production and in active productive use is around 100 000 hectares, whereas the total bog area that could be exploited in Finland for fuel peat production amounts to 600 000 hectares. At current consumption levels the country's peat reserves are expected to last for some 300 years. Peat production is concentrated in central and northern Finland and is a significant source of local employment.

The European Union has been conducting research into the use of renewable energy resources in the context of the ALTENER and SAVE programmes. In Finland, Government subsidies for investment in the use of renewable energy and energy conservation is up to 30 per cent of total investment costs. Projects working on the development of new technology may receive up to 50 per cent.

15. Production of renewable electricity in the EU countries in 1994

	Total electricity generated (GWh)	Percentage of total consumption*) (%)
Sweden	60 804	24,0
Austria	38 577	23,7
Finland	**18 584**	**18,3**
Portugal	11 690	16,7
Greece	2 644	7,2
France	80 429	7,2
Danmark	1 935	6,5
Italy	48 378	6,4
Spain	25 282	6,2
Ireland	869	2,2
Germany	24 641	1,9
Netherlands	1 774	1,4
Luxembourg	136	1,3
Belgium	869	0,8
Great Britain	7 007	0,7

*) Method used for the calculation of hydropower differs from that used in Finland.

An important element of Finland's energy policy is to promote energy conservation. Energy conservation is conducive to the attainment of the environmental objectives to which Finland has committed itself in interna-

tional conventions. Energy for heating buildings accounts for one-quarter of the country's total energy consumption, with dwellings accounting for 75 per cent of this. About 60 per cent of the heating energy produced goes towards heating and ventilation, 25 per cent is household energy and around 15 per cent goes towards the heating of water. Other factors with a bearing on total energy consumption are the production, recycling, and the re-use of building materials and equipment.

The energy economy of new buildings depends importantly on planning, building regulations, instructions, and technical systems. Awareness campaigns aimed at building users, residents, and those responsible for property management as well as property management itself play an important role in the promotion of energy conservation.

The potential for energy conservation is even greater in the old building stock. Improvements aimed at energy conservation are usually carried out in connection with other repairs. Sensible promotion of building conservation will therefore also help to conserve energy.

Taxes on energy

The Finnish system of energy taxation was overhauled at the beginning of 1997: taxes are no longer levied on the primary sources of electrical energy, but on the end-product, i.e. electricity itself. Although the fuels used in the production of electricity were exempted, a tax is still levied on the fuels used to produce heating energy. The new electricity tax was divided into a lower and higher tax bracket: the lower tax (1.675 pennies/kWh) is applied to industry and professional greenhouse gardeners, the higher tax (3.1 pennies/kWh) is applied to households, service industries, agriculture, and the public sector. For those in the lower tax band, this change reduced the price of electricity to some extent, for those in the higher tax band the price of electricity went up by a few per cent.

In the case of fuels used for generating heating energy, the tax is no longer based on energy content but on carbon content. The tax was doubled to FIM 70 per carbon dioxide ton. This put up the price of district heating produced by fuels subject to the energy tax by an average of two per cent.

This reform helped to improve the competitiveness of domestic electricity production in relation to imported electricity. It also removed the difficulties caused to Nordic electricity exchange by the previous tax system. The reform favours the use of low-emission fuels in the production of heating energy. In contrast, on the side of electricity production, taxation lost some of its impact as a regulatory mechanism. The decisions to raise electricity and fuel taxes in connection with the reform also contributed to the object of energy conservation.

16. Finland's energy taxes in 1997 (excl. VAT)

	Base tax	Additional tax
Reformulated petrol 95E p/l	291,9	16,4
City diesel oil p/l	144,9	18,6
Light fuel oil p/l	10,4	18,6
Heavy fuel oil p/l	–	22,1
Tall oil p/kg	22,1	–
Coal FIM/t	–	169,0
Natural gas p/m3	–	7,1
Peat FIM/MWh	–	4,2
Nuclear power p/kWH	–	–
Hydropower p/kWh	–	–
Imported electricity	–	–
Electricity tax class I p/kWh	–	3,1
Electricity tax class II p/kWh	–	1,675

The reform will earn the State an additional FIM 900 million in excise duties in 1997; in addition, through VAT the State will see an increase of FIM 200 million in energy tax revenues compared with 1996. This was taken into account in the decisions to reduce income taxes on labour.

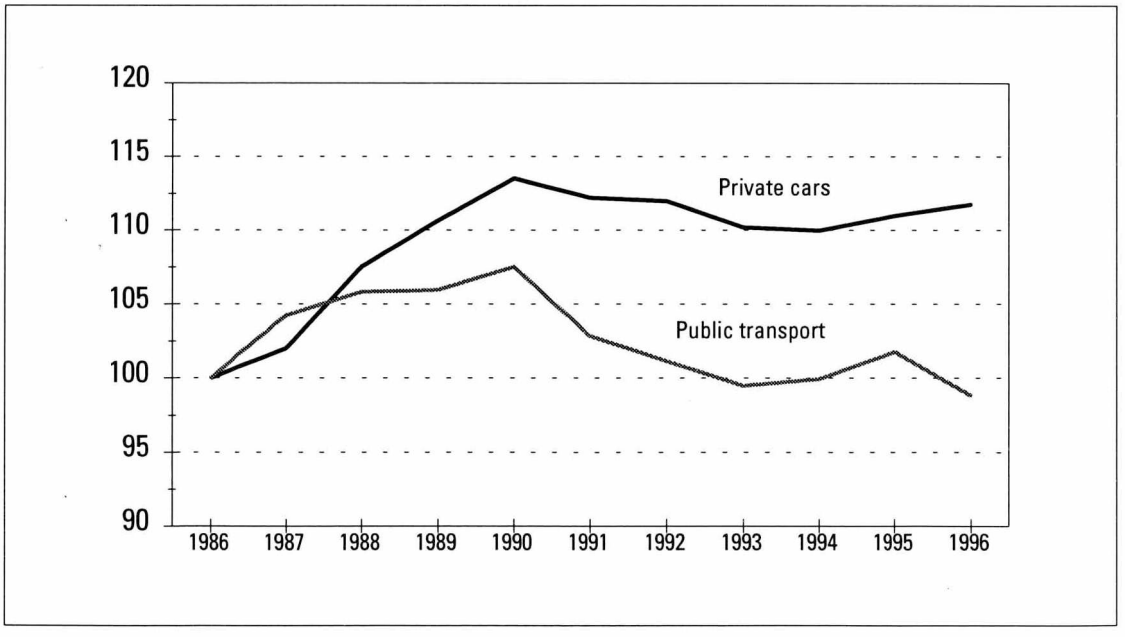
4 Transport

Trends in traffic volumes

Finland's per capita mileage is one of the highest in the European Union. Demand and cost of transport are results of the sparse population, decentralised community structure, and the remote location from the country's main export markets. The railways carry a far larger proportion of the goods traffic than in Central Europe. The traffic volumes took a downward turn in the early 1990s due to the economic recession, after several years of growth. During the past 20 years the share a public transport as a proportion of total passenger traffic has remained more or less unchanged. In certain urban areas its proportion has actually increased. The forecasts are that passenger traffic will grow by 30 per cent between 1995 and 2010, goods traffic by 42 per cent.

The costs of goods transport in Finland are 2–3 times higher than in European competitor countries. The higher costs are explained by the long distances, natural conditions, and the structure of manufacturing. The cost-effectiveness of the transport system has improved, helping to reduce costs during the 1990s by almost 10 per cent. The bulk of foreign transports are by sea. The proportion of road transport (65 per cent of domestic goods transport) has changed little during the 1990s. Railway transports account for one-quarter of domestic goods transport. Because of the rather sparse railway network, only long-distance goods transport can to some extent be transferred to the railways. Water transport accounts for less than nine per cent of domestic goods transports.

Diagram 10. Trends in public transport and private car use (1986=100)



Environmental impact

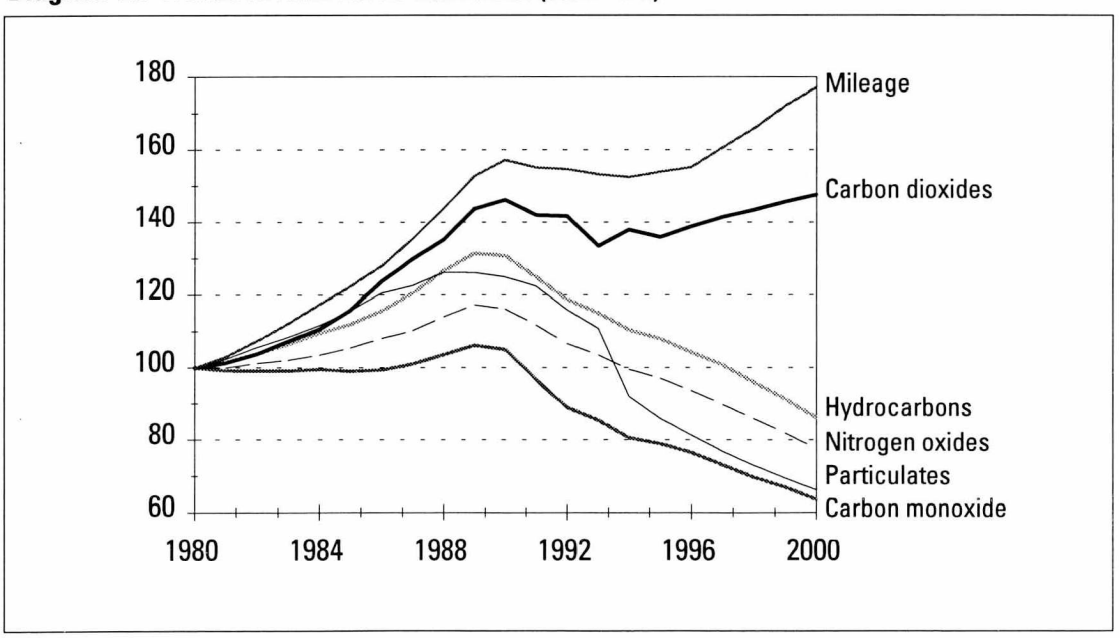
Traffic has the following environmental impacts:

- greenhouse gas emissions, such as carbon dioxide, methane, and nitrous oxide emissions
- other exhaust gas emissions, such as nitrogen oxide, sulphur oxide, carbon monoxide and particulate emissions
- emissions of volatile organic compounds
- groundwater pollution
- noise
- fragmentation of ecosystems and landscape
- waste

Vehicle emission limits have been considerably tightened during the 1990s. Lead emissions from petrol gas and sulphur emissions from diesel vehicles have been virtually eliminated in the early 1990s through changes in fuel quality. The new, cleaner fuels have reduced nitrogen, hydrocarbon, and carbon monoxide emissions by 10–15 per cent. Emission levels rose steadily until 1990 and the introduction of catalytic converters. The economic recession, which slowed down the growth of per capita mileage, also helped to reduce emissions. At the same time, however, the rate at which the vehicle stock renewed began to slow down, which in turn slowed down the reduction of emission levels. Carbon dioxide emissions from road traffic increase in proportion to the growing fuel consumption. Sulphur dioxide emissions have been dramatically reduced with the introduction of sulphurless diesel oil, which has also reduced particulate emissions. The environmental load caused by trains has been and will be further reduced by continuing electrification of the railway network.

In July 1996 the European Union adopted an articulated lorry directive to harmonise the maximum length and weight of heavy goods vehicles in Europe. However, Finland is allowed to keep its existing HGV stock on its own roads: the maximum limit for lorries in

Diagram 11. Trends in road traffic emissions (1980=100)



18. Road traffic emissions as a percentage of Finland's total emissions

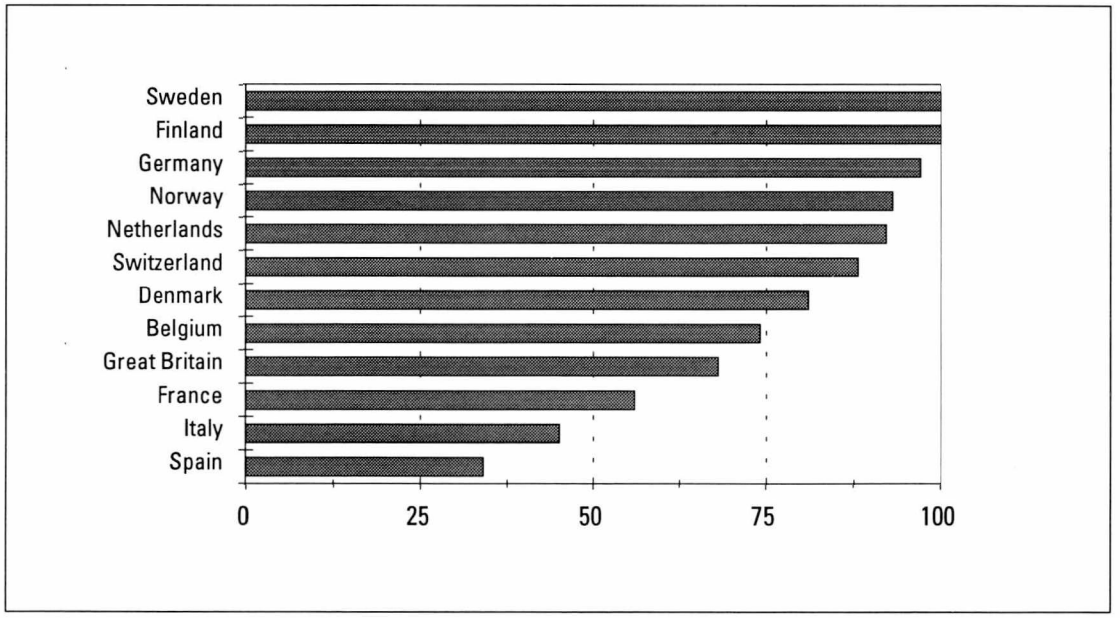
Type of emission	Road traffic's share
Carbon dioxide	75
Nitrogen oxides	60
Hydrocarbons	50
Carbon monoxides	25
Sulphur dioxides	5

Finland remains at 60 tonnes, elsewhere in the European Union the limit is 40 tonnes. This decision will bring annual savings of around FIM 400 million in transport costs.

The effective reduction of nitrogen oxide emissions calls for the use of catalytic converters in cars and new engine technology in heavy goods vehicles. However, the vehicle stock is slow to renew, and it is not until the turn of the millennium that almost all petrol cars in Finland will have catalytic converters. CAT cars account for over one-fifth of the total fuel consumption of private cars. All petrol that is consumed in Finland is unleaded. Almost all of the diesel oil sold in Finland is sulphurless.

The quality of outdoor air in Finland is better than in the densely populated areas of Central Europe, for example. Car emissions are controlled more extensively in Finland than in the other EU countries in connection with statutory annual testing. Air quality values are nowadays less frequently violated thanks to improvements in fuels. Carbon monoxide emissions rarely exceed the limits, but the norms for particulate and nitrogen oxide emissions are sometimes exceeded. The limits imposed in 1995 on particulate emissions from heavy goods vehicles and improved street cleaning will reduce particulate emissions further; this is in addition to the reduction of particulate emissions resulting from the reduced use of sulphur. As emissions of nitrogen oxides continue to decrease in finland with the newer cars on the road, the limits imposed for air quality will no longer be exceeded in the new millennium.

Diagram 12. Unleaded petrol as a percentage of total petrol sales 1996 (per cent)



The EU countries reached agreement on further steps for stricter fuel quality requirements in June 1997. The proposed directive is based on the Auto oil research programme which was launched several years ago with joint funding by the European Commission and the European automotive and oil industry. The aim is to reduce emissions from road traffic in the EU countries by 60–70 per cent by the year 2010 from the 1990 level. The proposed directive includes progressive changes in fuel quality requirements in the year 2000 and 2005. In the year 2000 the benzene content of petrol shall be restricted to one per cent, its sulphur content to 150 milligrams per kilogram, and the marketing of leaded petrol shall be banned. In addition, the European Union is preparing a strategy to reduce carbon dioxide emissions from private cars. The aim is to reduce fuel consumption in private cars to five litres and in diesel vehicles to 4.5 litres per 100 kilometres through joint agreements with the automotive industry.

Traffic pollution and taxation

In its Green Paper on traffic pricing the European Commission set a long-term target according to which taxes and fees levied on different modes of transport should also comprise external costs, such as those arising from pollution, congestion, accidents, and noise. The purpose is to collect the costs arising from the adverse effects of traffic from those causing the harm so that all forms of traffic carry an equal share of the burden relative to the external costs for which they are responsible.

External costs refer to all such costs from emissions, noise, congestion, and accidents that are not directly covered by those parties causing them. Surveys in Finland have shown that road traffic meets its own external costs.

In addition to using economic instruments, the environmental damage caused by traffic can be reduced by changing the relative shares and structures of different modes of transport and by community structure and land-use planning. An important strategy in the prevention of environmental damage caused by transport is to step up the assessment of environmental impacts prior to project planning. Most of these assessment projects in Finland are related precisely to traffic projects. Over half of all assessments completed and underway are concerned with the environmental impact of traffic projects.

Most of the tax and fee revenue connected with the environment comes from the tax on traffic and especially transport fuels, which are, however, collected mainly on fiscal grounds. In 1997, transport fuels are expected to yield about FIM 14.1 billion in taxes. Fuel taxes are graded on environmental grounds.

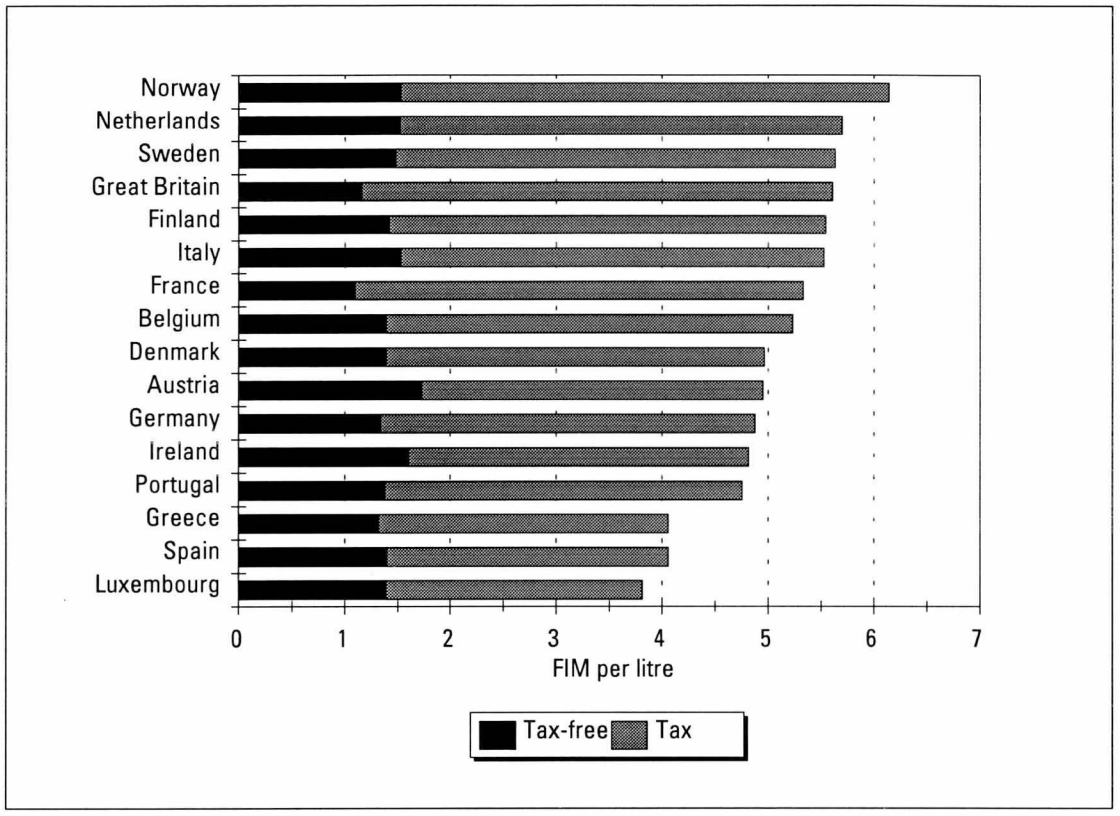
The proportion of taxes in the consumer price of petrol in Finland is the third highest in Western Europe, after France and Great Britain. The tax on diesel oil is approximately the average for Western Europe.

19. Surtaxes paid by road traffic (FIM million)

	1994 R	1995 R	1996 R	1997 B	1998 BP
Vehicle tax	618	1 046	1 040	1 070	1 140
Motor vehicle tax	844	668	860	870	900
Excise duty and VAT on vehicles	450	590	790	836	990
Total vehicle taxes	2 054	2 685	3 600	3 800	4 500
Excise duty and VAT on transport fuels	2 150	2 550	2 981	3 102	3 337
Fuel tax	9 815	11 628	13 550	14 100	15 170
Total	**15 931**	**19 167**	**22 721**	**23 778**	**26 037**

R = revenue B = budget BP = budget proposal

Diagram 13. Petrol (95E) consumer prices 14 June 1997



5 Natural resources

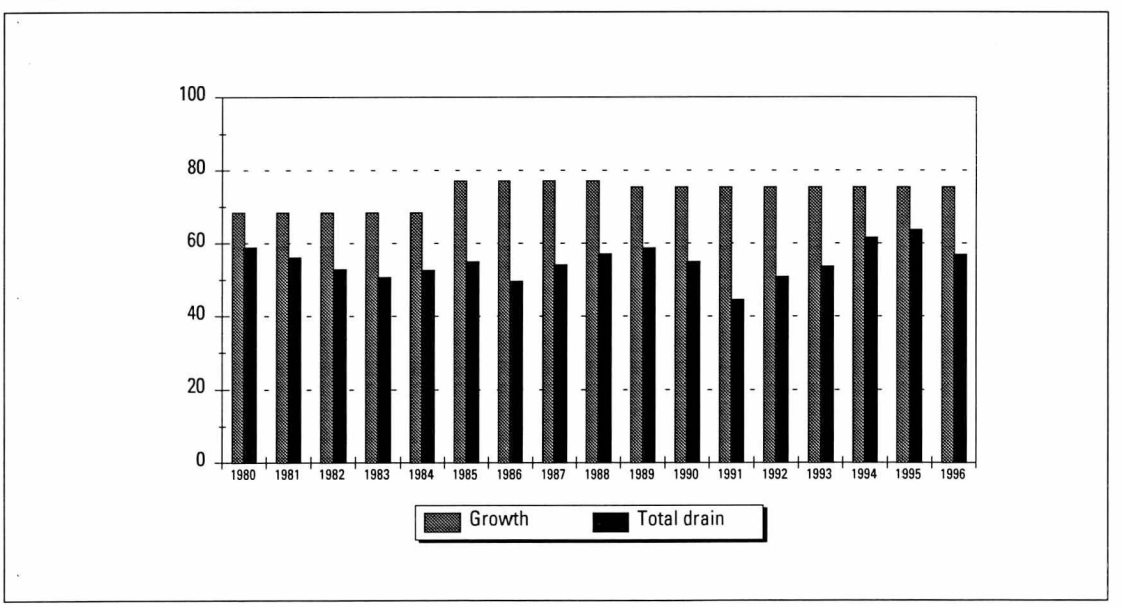
Timber resources

The forests are Finland's most important natural resource. The country has over 26 million hectares of forest land, i.e. 86 per cent of the land area is covered by forests. Forest soil proper amounts to 20 million hectares, the remainder being low-productivity or waste land. A new forest law entered into force at the beginning of 1997 to promote the economically and ecologically sustainable use and management of forests. The law is applied to all commercial forests. The purpose of the law is to make sure that the forests yield a good financial return at the same time as they retain their ecological diversity. In particular, the preservation of habitats that are important to the biodiversity is underlined as a priority concern. Significant losses caused to landowners by the protection of important habitats can be recompensated through the environmental support system for agriculture.

Forest growth in Finland clearly exceeds the drain; even the total drain, which comprises waste wood and natural drain as well as fellings, is clearly lower than the annual growth for pine, spruce, and broadleaves. According to a forest inventory conducted between 1989 and 1994, the average annual wood growth in Finland was over 75 million cubic metres. In 1996, a total of 55.6 million cubic metres of wood were cut for industry and other human uses. Allowing for waste wood and natural drain, the total drain from the Finnish forests was 57 million cubic metres.

Private individuals constitute the biggest group of forest owners in Finland: they own 54 per cent of the commercial forest land, companies own 8 per cent, and the State 33 per cent. In 1996, forest owners' net earnings from stumpage prices totalled FIM 6.5 billion. The forest economy accounts for around 2.6 per cent of Finland's GDP.

Diagram 14. Forest growth and total drain (million cubic metres)



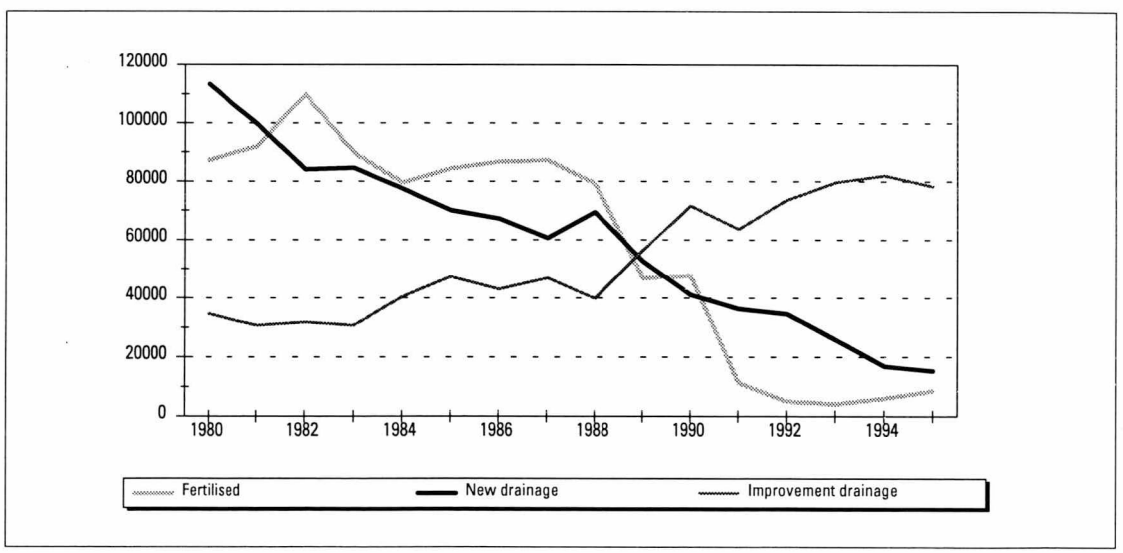
Approximately half of the forest land is carpeted by lingonberry and blueberry shrubs. In a good year, the berry harvest is around one billion kilograms, of which 40 per cent is suitable for consumption. The amount that is actually picked in a good year amounts to around 40 million kilograms, i.e. around 10 per cent of the berries suitable for consumption. The mushroom harvest amounts to around two billion kilograms, of which 60 per cent is edible. In 1996, the value of other forest products taken for commercial and personal use was FIM 239 million, of which berry picking represented FIM 159 million and mushrooms FIM 31 million.

A significant proportion of Finland consists of natural forests in commercial use; the way in which these forests are treated is crucial to the protection of their biodiversity. The systematic increase of wood resources by means of planting, intensive forestry, drainage, and fertilisation has adversely affected the diversity of the forest nature and led to a reduction of old-growth forests, tree species of limited commercial value, and rotten wood. The forest economy environment programme and the related silviculture recommendations have in recent years improved the forestry methods to make a greater allowance for the care and protection of the forest's diversity. These recommendations have been widely put into practice in forestry.

The introduction at the beginning of 1997 of new environmental protection and forest legislation was aimed at reconciling the various demands on commercial forests in order to guarantee the biological diversity of forests and a forest economy that is economically sustainable. The conservation of valuable natural areas as specified in the new forest law will reduce cutting volumes by 7–10 per cent depending on the area. A proposal outlining the principles of a certification system suited to the conditions in Finland was completed in spring 1997. Virtually all forestry organisations and interest groups as well as environmental and other civic organisations took part in drafting this proposal.

Forest utilisation and management were also high on the agenda at the UNGASS Conference where an intergovernmental forest fo-

Diagram 15. Forests annually fertilised and drained (hectares)

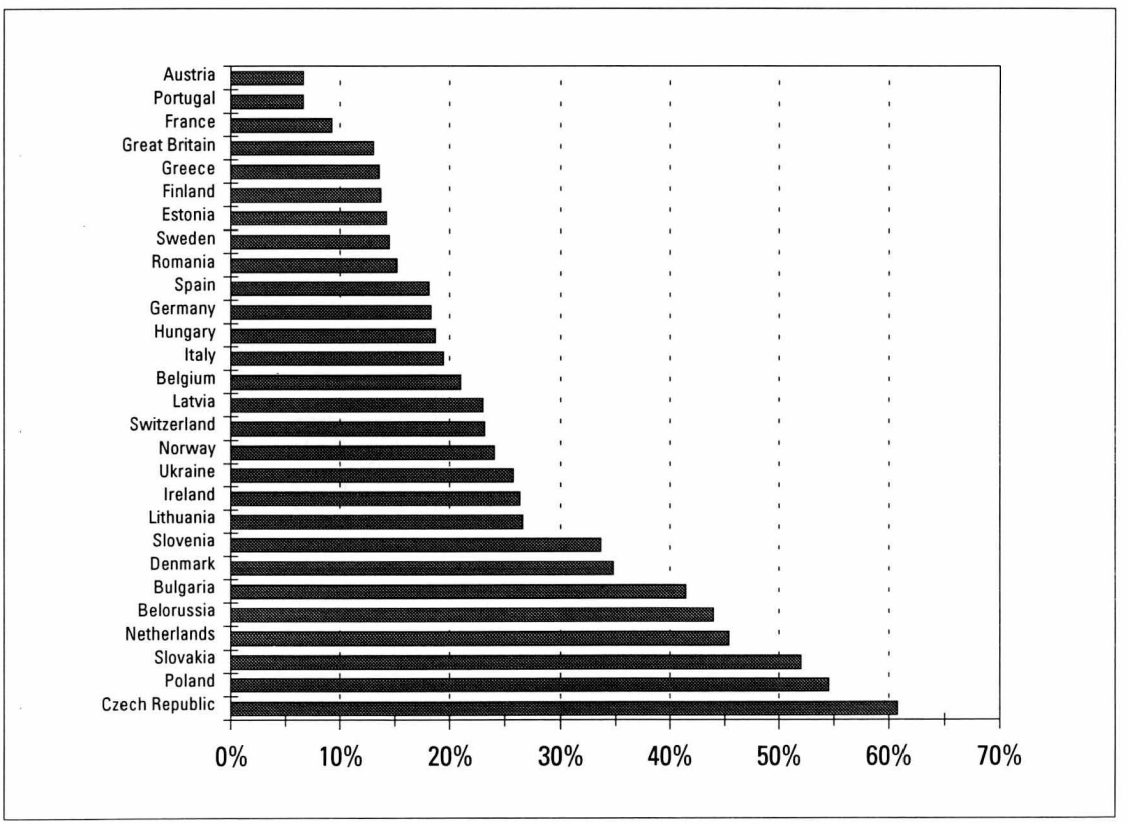


rum was set up to continue the work of the forest panel established in Rio. The forum shall define the key elements that are to be included in the forthcoming forest convention. It will be submitting its report to the UN Committee on Sustainable Development in 1999.

Defoliation is widely used as a measure of forest health. Judged on this basis, Finland's forests are in reasonably good health in comparison with other European countries. Defoliation and foliage symptoms in Finland are explained by airborne pollution, the comparatively young age of forests, and by weather and climate factors. Older trees show foliage symptoms far more readily than younger trees that are still growing. In addition to needle and foliage damage, airborne pollution may also cause adverse changes in the soil and root systems, causing forest growth to slow down.

Finland's forests are substantial carbon dioxide sinks and contribute to combatting the intensification of the global greenhouse effect. Forests bind carbon dioxide as long as the total biomass of the forest vegetation is in the process of growth, which is the case in Finland's forests where the age structure is young and silvicultural measures are effective. In the early 1990s the annual net accumulation of carbon in Finnish forests has corresponded to some 37–55 million tonnes of carbon dioxide; at the same time, 51–60 million tonnes of carbon dioxide were released in emissions from fossil fuels. It is estimated that the volume of carbon bound in the Finnish ecosystems will continue to grow for at least the next 15–20 years.

Diagram 16. Percentage of coniferous trees showing needle shedding in excess of 25 % in European countries in 1995



Cultivated resources

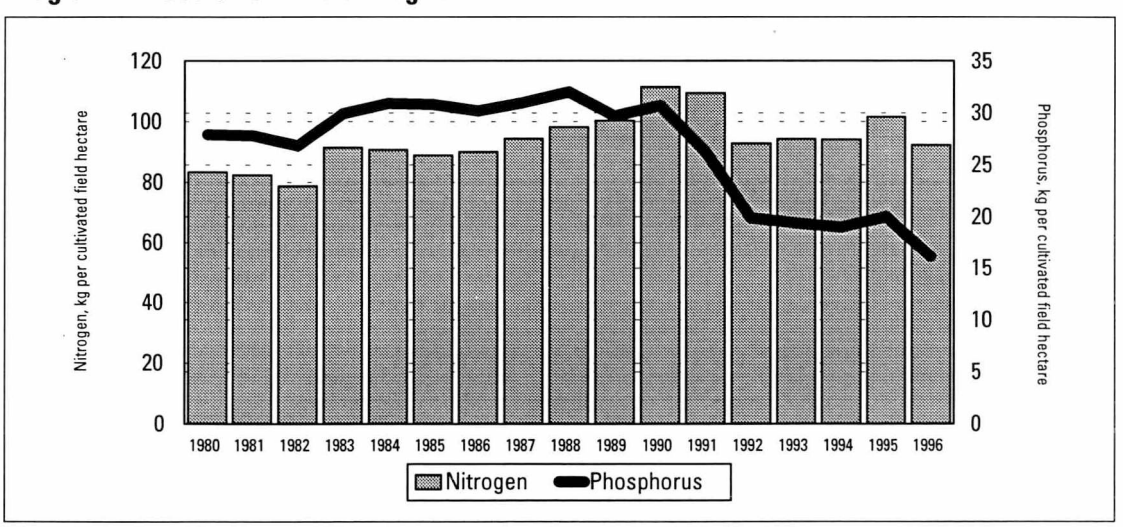
Eight per cent of Finland's land area is farmland. There is a total of around 2.5 million hectares of farmland, i.e. fields and gardening land, of which around 1.95 million hectares were under cultivation in 1996. The average farm size is 75 hectares, of which forest land accounts for 45 and arable land for 12 hectares. Half of Finland's farms (90 000) are in active production, and their average acreage of arable land is almost 20 hectares. No more than one-third of all farms are run on a full-time basis.

Agricultural production is based primarily on animal husbandry; 80 per cent of all arable land is devoted to growing grass, silage, and fodder crops. Dairy farming and beef production account for almost half of total agricultural output. There are 0.4 million cows, 1.4 million pigs, 10 million chicken and broilers, and 0.2 million sheep. In 1996 total agricultural output was FIM 20.4 billion, of which subsidies paid out accounted for 45 per cent.

The most important direct impact of agriculture on the environment is the runoff into the waterbodies and groundwater of the nutrients contained in fertilizers. Agriculture is responsible for 40 per cent of the total phosphorus load on the waterbodies and for 30 per cent of the nitrogen load. Southern and southwestern Finland account for over half. Nutrients are responsible for the eutrophication of waterbodies and in general have adverse effects on water quality. In some areas the impact of agriculture is also seen in elevated groundwater nitrate contents. The relative impact of the waterbody load caused by agriculture has been accentuated during the past decade as industrial and municipal waste water management have been intensified. One of the most important challenges for water protection over the next few years is to reduce the load of agriculture on the waterways.

When Finland joined the European Union and adopted the environmental support system for agriculture, environmental protection was at once adopted as a criterion for the allocation of agricultural subsidies. The objectives of the Finnish environmental programme for agriculture for the period 1995–1999 are to improve the standards of water protection on farms, to reduce the level of air pollution and

Diagram 17. Use of fertilizers in agriculture



to preserve the traditional rural landscape and biodiversity. The programme also aims to eliminate the direct load on the waterbodies caused by animal husbandry and the production of silage. Since 1995 over FIM 1.5 billion has been paid out each year in environmental support to farmers, of which the EU covers half. The support compensates farmers for costs and loss of income resulting directly from implementation of the programme and guarantees an income for farmers in the changing circumstances. In May 1997 the European Union decided, in response to a Finnish initiative, to increase its annual payments by some FIM 60 million on condition that the part financed by Finland is increased accordingly.

To qualify for basic environmental support, farmers are required to draw up an environmental management plan for their farm, to adhere to the limits imposed for the use of nutrients, and to establish protective zones along waterbodies and streams as well as along ditches adjacent to arable land. Most of the special forms of environmental support for agriculture are intended for the promotion of water protection. The measures include the establishment of wide protective zones under perennial vegetation on fields adjacent to waterbodies or in groundwater areas, the establishment and management of settling basins to collect runoff and nutrients from cultivated fields, and support for organic farming.

Farmers are free to decide whether or not they want to join environmental programmes. About 85 per cent of active farmers (and accordingly of the area under cultivation) have committed themselves to comply with the conditions for basic support. If the programme is implemented in its full extent, it is estimated that the load of agriculture on waterbodies will be reduced by 20–40 per cent.

Another objective of the environmental support programme for agriculture is the preservation of biodiversity and the traditional rural landscape. Conventions concerning the management of biotopes are aimed at securing the preservation of habitats created by traditional

20. Environmental support for agriculture (FIM million)

	1995 R	1996 R	1997 B	1998 BP
1. Basic support	1 329.7	1 367.0	1 367.0	1 384.0
2. Special support	76.5	158.0	164.0	306.0
2.1 Organic production	*36.5*	*99.5*	..	..
2.2 Protective zones	*1.1*	*2.8*	..	..
2.3 Treatment of runoff	*33.2*	*41.7*	..	..
2.4 Intensification of fertilizer use	*0.9*	*1.1*	..	..
2.5 Landscape management and biodiversity	*2.3*	*9.4*	..	..
2.6 Diversification of production	*0.1*	*0.1*	..	..
2.7 Native breeds	*2.4*	*3.4*	..	..
3. Training and counselling	8.7	10.0	8.0	..
4. Experimental projects	5.0	8.0	7.0	..
5. Other	–	27.0	30.5	..
Total	**1 419.9**	**1 570.0**	**1 576.5**	**1 690.0**

R = revenue B = budget BP = budget proposal .. = data missing

agriculture and the plant and animal species living in those habitats. There is also an agreement for the protection of Finland's indigenous domestic animal species. At year-end 1996 a total of some 4 500 holdings with a combined arable acreage of 105 000 hectares were organically farmed or in transition to organic farming.

Fur farming is extremely important to local economies and a major source of income for the farmers involved. In 1996 there were some 2 250 fur farms in operation, half of which were run by farmers. Fur production is largely concentrated in the province of Vaasa on the west coast, which accounts for about 85 per cent of Finland's total production. In 1995 Finland accounted for approximately 60 per cent of the world's fox skin production. Fur farms are major sources of local environmental loads: problems occur most typically when melt water from snow or rainwater gets in contact with animal manure. The environmental hazards of fur farming can be reduced by careful maintenance, proper treatment and use of manure, treatment of runoffs, and the development of feed composition.

A clean environment and high-quality methods provide an important basis for the production of high-quality products. Finland's agricultural produce is free from pollution because the cold winter means that farmers in Finland can use less pesticides than farmers elsewhere in Europe. In addition, given our lower air pollution deposition, the environment in general is cleaner. In many industrial countries average exposure to heavy metals in the population is 2-5 times greater than in Finland. Indeed, products subject to the quality control system and organic products in particular will in the near future play a major role in the export of agricultural products.

Fish production and reindeer husbandry

Reindeer husbandry is important to the local economy in northern parts of Finland and an integral part of the culture of the indigenous people of Lapland, the Sami people. Reindeer farmers let their herds graze freely in the wilderness and only bring them in once or twice a year to be branded and slaughtered. Improvements in tools and equipment and growing demands on profitability have resulted in the growth of reindeer populations over and above the sustainable level and in serious damage being caused to the vegetation in northern Finland. Because of the large size of reindeer herds and the new grazing methods, some of the natural grazing grounds are in a poor condition. Artificial feeding has been introduced in attempt to arrest this development. Finland's reindeer population peaked at almost 430 000 animals in the early 1990s. Today, the figure is under 350 000. Each year, a total of 120 000–130 000 reindeer are slaughtered, leaving a stock of over 200 000 survivors. The number of surviving animals is determined by the Ministry of Agriculture and Forestry.

Finland has extensive fish waters, with 60 indigenous species that reproduce naturally. Around 20 of these species are fished. The average annual catch in inland waters is around 15 kilograms per hectare, in salt water the figure is in excess of 20 kilograms. The current catch levels are sustainable in the case of most fish populations, but there are great differences between different species and areas in this regard. Around two million people fish for recreation. In 1994 they caught 35 per cent of the total annual catch, but as much as 93 per cent of the catch of inland waters. Measured by the amount of catch the most important species are perch, pike, roach, bream, and white fish, which together account

for three-quarters of the annual catch. The market value of the annual catch is FIM 420 million. The number of professional fishermen has sharply declined in recent decades, even though the total catch has remained more or less unchanged or even increased with the introduction of more intensive fishing methods. Ninety per cent of the professional catch consists of Baltic herring.

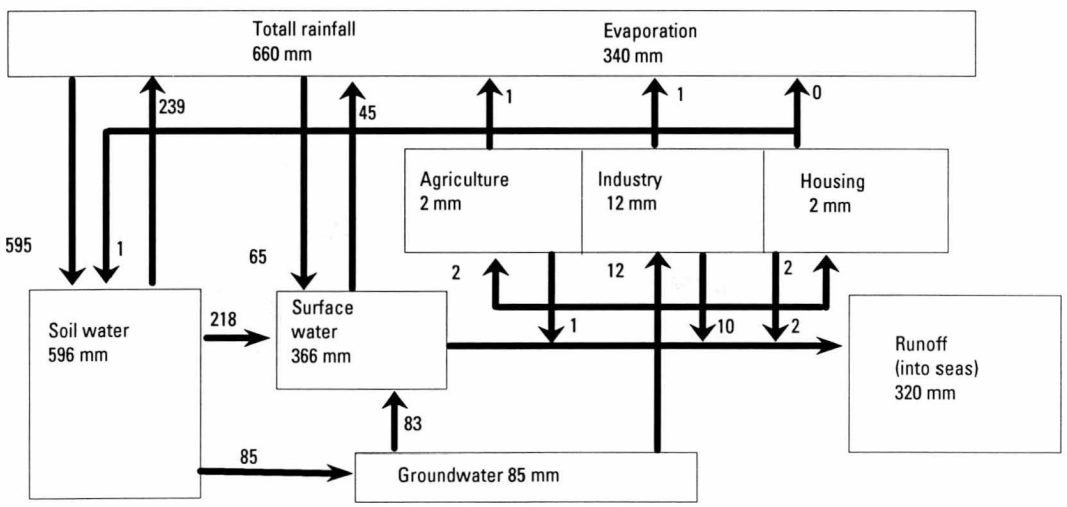
Fish production at fish farms totals almost 18 million kilograms a year, which mostly consist of rainbow trout. Emissions from fish farming increased until the late 1980s with the sharp growth of production volumes, but during the 1990s the load has steadily declined. Although fish farming accounts for only a minor proportion of the total phosphorus load on Finland's waterbodies, it may have a significant local impact. One problem which deserves special attention and which is the primary target of emission reduction efforts is the farming in the sea areas off the coast of southwestern Finland.

In 1995 the value of the professional fish catch was FIM 166 million, that of fish grown on fish farms FIM 286 million, and that of imported fish FIM 678 million.

Water resources

Relative to its population and water consumption Finland has abundant surface and groundwater resources. The inland waters cover 10 per cent of the total area, i.e. 33 500 square kilometres and the territorial waters 36 000 square kilometres. The total yield of Finland's groundwater is estimated at 10–30 million cubic metres a day, of which approximately 6 million cubic metres is suitable for water supply purposes. Around 15 per cent of these groundwater reserves are used for water supply. Almost 60 per cent of the water used by waterworks consists of groundwater or artificial groundwater. In 1995 consumption of water distributed by public waterworks continued to fall, standing at 256 litres per sub-

Diagram 18. Circulation of water (millimetres per year per total area of Finland)



1 mm = 10.7 cubic metres per second

21. Use of water resources in certain European countries (million cubic metres per year)

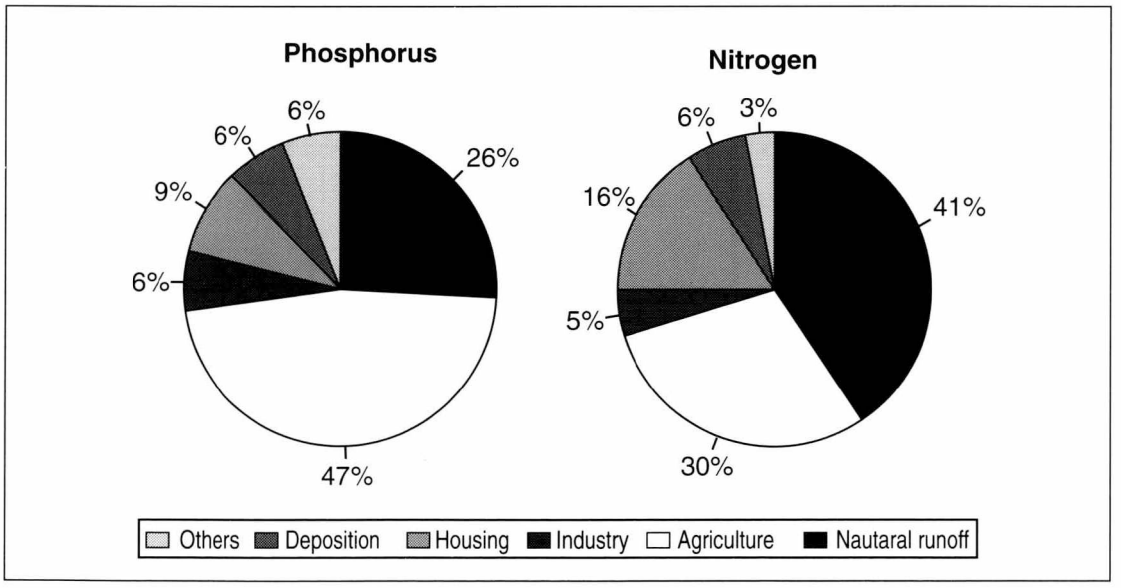
	Renewable water resources	Water supply	Intensity of water use (%)
Belgium	12 500	9 030	72
Spain	117 000	36 900	32
Italy	175 000	56 200	32
Estonia	15 000	3 300	22
Breat Britain	120 000	14 237	12
Greece	58 650	6 945	12
Denmark	13 000	1 200	9
Russia	1 500 000	106 227	7
Sweden	168 000	2 932	2
Finland	**108 000**	**3 001**	**3**
Switzerland	54 000	1 166	2
Norway	39 200	2 025	1

scriber connection per day. Water consumption by industry, communities, and energy production totals around 2 500 million cubic metres a year. Each year 2–4 per cent of Finland's accessible water resources are utilised.

About 80 per cent of Finland's lakes are classified as good or excellent in terms of water quality. Some three per cent are classified as polluted but of fair quality, 0.3 per cent of the total lake area is heavily polluted and of poor quality. The area of heavily polluted waterbodies has decreased in recent years, particularly in areas where industrial and community waste loads are high. At the same time, however, the area of unpolluted lakes in their natural state has grown smaller as a result of stray loads. Further steps are needed to halt the eutrophication of the Baltic Sea, both in Finland and other runoff areas around the Baltic Rim. Finland is responsible for 10 per cent of the phosphorus load and for 9 per cent of the nitrogen load that enters the Baltic Sea from land areas. The biggest single source around the Gulf of Finland is the St. Petersburg region, with nutrient emissions exceeding the load from Finland five times over.

The phosphorus and nitrogen loads caused by industry, communities, and fish farming are continuing to decline. Agriculture is responsible for 47 per cent of the total phosphorus load on the waterbodies and for 30 per cent of the total nitrogen load. Stray loads are clearly

Diagram 19. Sources of loads on the waterbodies in 1995



beginning to decrease in many areas; measures introduced under the environmental support programme for agriculture have played a major role in this regard. In addition a total of 384 lakes have been rehabilitated in Finland [between 1970 and 1995], mostly in the form of oxidisation, cutting down water plants, and raising water surface levels. State funding for rehabilitation projects during 1988–1995 has amounted to FIM 15–28 million per annum. The construction of hydropower is slowing down with the completion of the last flood control projects. It is important to make sure that issues of health, safety, landscape protection, and the state of the environment continue to receive equal treatment with the requirements of economic sustainability in the planning of Finland's water resources.

Unlike the countries of Central Europe Finland has comparatively small groundwater basins and the soil layers protecting them are rather thin. According to a major groundwater classification project that was completed in 1996, there is considerable regional variation in the quality of groundwater. The Finnish groundwaters are extremely sensitive to acidification because most rocks in the Finnish bedrock are acidic. Impurities in the air have already had some impact on the quality of groundwater in southern and southeastern Finland. In some areas the risk of groundwater contamination is exacerbated by agriculture, the use of de-icing salt, sand and gravel pits, landfill sites, absorption of wastewater, transport and storage of oils and poisonous substances, urban development, and industry. The implementation of the EU drinking water directive in Finland has called for stricter water quality requirements. In particular, iron and manganese removal needs to be improved, and groundwater plants are required to introduce deacidification processes.

One of the key conclusions of the European Commission's report on the development of water policy in 1996 was that European water legislation needs to be harmonised and that a broader perspective needs to be taken so that all factors with a bearing on the state of waterways and the sufficiency of water are taken into account. Joint consideration must be given to qualitative and quantitative water issues, problems related to surface water and groundwater, water use and water protection, emission levels and quality norms, and to reconciling water policy and other policies. On the basis of this report the Commission issued its proposal for a framework water policy directive in spring 1997.

6 Nature conservation

Nature conservation is aimed at the preservation of the biodiversity. This objective is pursued by setting up conservation areas to protect untouched areas of the environment, by protecting endangered species, and by integrating the interests of nature conservation with the demands of land-use planning as has been the trend in recent years. In Finland preservation of the biodiversity is particularly important with regard to the sustainable use of commercial forests. The country's network of nature conservation areas has been gradually expanded since the late 1970s with the inclusion of different types of biotypes and habitats through nature conservation programmes. The oldest of these programmes, the national park and nature reserve development programme, has for the main part been completed.

Nature conservation areas covering 1.36 million hectares and wilderness areas covering 1.5 million hectares have been established on State lands. Some 10.4 per cent of forest land area is protected. The sum of FIM 1 200 million was spent on the purchase of and compensation for conservation areas between 1971 and 1996. In addition, state lands with a total value of FIM 350 million were exchanged. Of the protection programmes, 167 000 hectares have been on private land. The Government still has plans for some 250 000 hectares more conservation area and certain other protected areas.

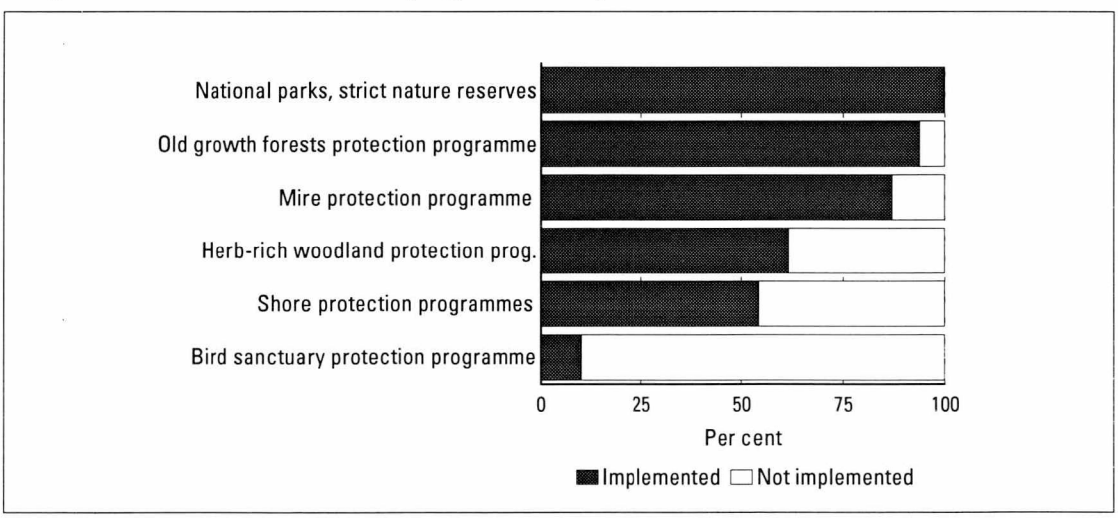
The speed with which areas under the conservation programmes are purchased is to be

22. Finance of nature conservation areas and programmes 1994–1998 (FIM million)

	1994 R	1995 R	1996 R	1997 B	1998 BP
Purchase of areas	161	183	159	321	362
Purchase of private land	*85*	*89*	*87*	*111*	*117*
Land exchanges	*67*	*87*	*80*	*110*	*150*
Income from land sales	*9*	*7*	*17*	*100*	*95*
Area management	85	75	75	74	75
Conservation area compensations	20	19	19	43	47
Rapids protection	100	35	45	25	45
Life (Natura)	–	–	8	15	20
Total	**366**	**312**	**306**	**479**	**549**

– = not in use
B = budget
R = revenue
BP = budget proposal

Diagram 20. State of conservation programmes on private land 1 Jan 1997



greatly increased over the next few years. According to the overall financing plan for nature conservation programmes adequate resources shall be guaranteed for the implementation of these programmes. The aim is to complete programme implementation by the year 2004, with funding extending to the year 2007. A total of FIM 3 285 million (including lands exchanged) has been set aside for the funding of this programme.

Although the importance of preserving the biological diversity of the natural environment is widely recognised, our knowledge of many different habitats and organisms remains incomplete. In 1997 the Finnish Environment Institute launched a three-year programme to examine the current state of the Finnish nature conservation system and to assess its ability to guarantee the preservation of different types of ecosystems and endangered species. The project shall also assess the efficacy of nature conservation measures and the attainment of the objectives set. In 1977 the Ministry of the Environment also launched a major study into endangered species.

A completely revised Nature Conservation Act took effect as from the beginning of 1997. The new law provides nature conservation with a much wider range of tools particularly with regard to the preservation of biotypes and species. The Act also satisfies the demands of the EU nature and bird directives. The directives shall be enforced by creating a network of protected areas, known as Natura 2000. The proposal put forward by the Ministry of the Environment for Finland's Natura 2000 network comprises a total of 4.9 million hectares, or about 11 per cent of Finland's total area. State lands included in the proposal amount to 2.55 million hectares. Within the Natura areas protection can be implemented in various ways depending on the need for protection in the case of each biotype and species. The European Commission will be making its final decision on the network in 1998. According to the nature directive the Natura network should be complete by the year 2004.

The EU LIFE fund is contributing to the implementation of the Natura 2000 network. The fund has an annual budget of some ECU 450 million, 40 per cent of which is allocated for nature conservation purposes and about 50 per cent for new innovative environmental technology projects. In 1997 the Commission will be allocating a total of some FIM 240 million to LIFE projects, of which Finland's share is FIM 35 million.

23. Natura barometer in the EU countries 17 June 1997

	Proposal for programme	Number of areas	Total area (hectares)	Estimate % of land area
Greece	Final	245	26 590	17
Italy	Final	2 440	40 592	14
Sweden	Partly completed	1 047	43 736	10
Finland	Partly completed	415	25 599	8
Ireland	Final	207	5 530	8
Denmark	Final	175	11 000	7
Austria	Partly completed	97	3 620	4
Belgium	Final	102	903	2
Great Britain	Partly completed	255	13 322	2
Spain	Isles only	174	8 015	2
Holland	Partly completed	27	2 820	2
Portugal	Partly completed	30	414	1
Germany	Starting	80	1 176	0
France	No	0	0	0
Luxembourg	No	0	0	0
Finland	**MoE proposal**	**1 482**	**49 394**	**11**

24. Nature conservation funding plan 1996-2007 (FIM million)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Allocations	106	149	175	185	185	185	185	185	185	185	185	185
Interest expenditure	0	9	12	15	12	10	10	10	10	6	3	3
Land exchanges	180	110	120	100	60	60	60	60	60	–	–	–
Income from land sales	50	100	90	40	–	–	–	–	–	–	–	–

– = not in use

7 Towards sustainable development

Many trends with potentially hazardous effects on the natural environment in Finland have been stopped and even reversed in recent years, many pressures have been eased. However, it takes several years or even decades for real, visible changes to take place in the environment. The speed of these changes is largely dependent on the results achieved on international fora. In Finland the factors threatening the diversity of the natural environment have been alleviated to such an extent that it seems likely it will be possible over the next few decades to maintain the biodiversity at its present level. There are also signs of a change for a better in the recent trends of acidification of forests and waterbodies. On the other hand, considerable effort is still needed to combat the greenhouse effect, the depletion of the ozone layer in the upper layers of the atmosphere the accumulation of ozone in the lower layers and the eutrophication of waters. The environment is also coming under increasing pressure from urban development and the building of new industrial and transport areas as well as holiday homes.

Significant changes are called for in the production and consumption patterns of industrial societies if they are to attain the goal of a more sustainable future. During the past five years we have seen many important results achieved worldwide within the framework of a policy of sustainable development, which was first defined at the United Nations Conference on Environment and Development in Rio de Janeiro in 1992. At the Rio follow-up meeting in New York in summer 1997, the world states reiterated their commitment to the action plan agreed upon in Rio, which forms the basis for the policy of sustainable development. However, this policy has not yet led to any major changes in the state of the environment or in the use of natural resources.

Finland is actively involved in the implementation and development of the Rio conventions. The Government is currently working on its programme for sustainable development. The country's own list of measures for sustainable development was completed in 1995, and during 1997 trade, industry, entrepreneurs, local municipalities, and agricultural and forestry producers have all finalised their respective action plans. In addition some civic organisations have drawn up a joint action programme. As a member of the European Union Finland is also committed to the Union's environmental protection targets. The fifth EU environmental programme and the Treaty of Maastricht both call upon the Member States to work for a high standard of environmental protection. The biodiversity in the union is guaranteed by the Natura 2000 conservation area network. The preparation of Finland's proposal is underway.

Environmental reporting by business corporations is increasing all the time. According to a recent international study 71 per cent of major corporations compiled environmental reports, with the highest figures reported for the United States, Sweden, Canada, and Germany. In Finland the Ministry of Trade and Industry and the Ministry of the Environment are arranging a competition in autumn 1997 for the best environmental report.

Over the next few years Western industrial countries will see a further strengthening of trends that are aimed at a closer linking of environmental interests with the demands of economic sustainability. In particular, there is

a growing need in economic decision-making for indicators to describe sustainable development. Evaluation systems for environmental management and environmental impacts, such as life-span analyses and environmental accounting systems to complement national accounts, provide such information for decision-making purposes. Working closely with the EEA and Eurostat, the Statistical Office of the European Communities, the Finnish Ministry of the Environment, Statistics Finland, and the Finnish Environment Institute shall continue to compile and summarise scientific and economic information on the environment and make that information available to decision-makers in an easily accessible format.

The most important agreements on the conservation of natural resources and the environment binding on Finland

Agreement	Aim	Implementation
Climate change UN Framework Convention on Climate Change, 1994.	To stabilise concentrations of greenhouse gases in the atmosphere at a safe level. Initial aim to halve growth in greenhouse gases by 2000 and to regain the 1990 level.	In April 1995 the parties decided about a negotiation process with the intention of concretising the objectives of industrialised countries after the year 2000 by the end of 1997. In summer 1995 the Ministry of the Environment set up a committee to prepare Finland's targets for climate change.
Substances that deplete the ozone layer in the upper atmosphere Montreal Protocol, 1987.	To stop and restrict use of substances that deplete the ozone layer.	Use of halons prohibited in new equipment as of January 1, 1993. Use of tetrachloromethane prohibited as of August 1, 1993. Use of CFCs prohibited as of January 1, 1995, except for drugs inhaled into respiratory tract. Use of 1,1,1-trichloroethane prohibited as of January 1, 1995.
Sulphur emissions Oslo Protocol, 1994.	The long-term objective is to ensure that sulphur depositions do not exceed the critical loads in each area. The first step is to reduce the excess by 60 per cent by the year 2000. To this end, Finland engages to reduce sulphur emissions by 80 per cent on the 1980 level by 2000.	Finland signed the Protocol in 1994. It has not taken effect. In 1994 Finland's emissions were 80 per cent lower than in 1980. Keeping emissions at this level nevertheless requires extra measures.
Emissions of nitrogen oxides Protocol on the Control of Emissions of Nitrogen Oxides and their Transboundary Fluxes, 1988. Declaration on the reduction of nitrogen oxide emissions, 1991.	In the Protocol Finland engages to freeze emissions of nitrogen oxide at the 1987 level by the end of 1994. In the Declaration Finland announced its intention to reduce emissions by 30 per cent on the 1980 level by 1998.	In 1995 emissions of nitrogen oxides had decreased by more than 4 per cent on the 1987 level.
Volatile organic compounds International Protocol on the Control of Emissions on Volatile Organic Compounds and their Transboundary Fluxes, 1991.	To cut emissions of volatile hydrocarbons by 30 per cent on the 1988 level by 1999.	The agreement has not yet taken effect. Finland ratified the Protocol in January 1994.

Agreement	Aim	Implementation
Biological diversity General Convention on Biological Diversity, 1994.	The objective is the protection and sustainable use of the diversity of global ecosystems, animal and plant species and their genes, and the equitable division of the benefits gained from the use of biological natural resources.	The national report assessing the state of biodiversity in Finland will be completed in 1996. The committee on biodiversity completed a national action programme for biological diversity in summer 1997.
Protection of the Baltic Helsinki Convention, 1974, Helcom recommendations 1980-. Ministerial declaration, 1988. Convention on the Protection of the Marine Environment of the Baltic Sea, 1992.	Aims include reducing the nutrient and heavy metal load on the Baltic and nondegradable or toxic organic substances by 50 per cent by 1995 and protection of the marine environment.	Targets will be integrated into national legislation and programmes, into Water Court decisions on individual cases and will be pursued through economic instruments.

Statistical appendix

1. Pulp and paper industry production and waterbody load (thousand tonnes per year)

	Paper and board production	Pulp production	Chemical oxygen consumption	Organic chlorine compounds	Phosphorus
1990	8 958	5 093	433	9.7	0.641
1991	8 777	4 894	382	7.2	0.532
1992	9 145	4 913	330	4.7	0.461
1993	9 953	5 589	271	3.0	0.379
1994	10 909	6 331	265	2.0	0.338
1995	11 012	5 797	256	1.6	0.320
1996	10 442	5 739	213	1.1	0.250

Source: Finnish Environment Institute.

2. Pulp and paper industry production and atmospheric emission (thousand tonnes per year)

	Paper and board production	Pulp production	Sulphur	Nitrogen oxides	Particles
1990	8 958	5 093	24 100	16 200	22 000
1991	8 777	4 894	16 300	18 900	18 300
1992	9 145	4 913	9 500	19 100	13 000
1993	9 953	5 589	7 200	21 300	11 000
1994	10 909	6 331	6 500	23 000	9 500
1995	11 012	5 797	4 900	21 100	7 800
1996	10 442	5 739	5 300	21 100	7 000

Source: Finnish Forest Industries Federation.

3. Recovery of waste paper in different countries in 1995 (%)

Germany	67
Austria	66
Netherlands	66
Finland	**57.5**
Sweden	52.5
Japan	52
United States	44
Norway	43
Spain	41
Belgium	39
Canada	39
France	38
Portugal	37
Great Britain	35
Italy	29

Source: Pulp and Paper International and Finnish Forest Industries Federation.

5. Total energy consumption per GDP unit in certain countries in 1994

	Total energy consumption Kg of oil/ FIM 1000	Electricity consumption kWh/inhabitant		Total energy consumption Kg of oil/ FIM 1000	Electricity consumption kWh/inhabitant
Canada	76.0	16 745	Sweden	45.0	15 832
Turkey	69.6	1 209	Great Britain	43.4	5 540
Luxembourg	67.4	14 013	Ireland	42.4	4 512
United States	67.3	12 694	Germany	38.2	6 047
Iceland	65.3	17 481	France	37.8	6 758
Greece	54.9	3 620	Spain	37.4	3 992
Belgium	52.3	7 169	Norway	34.8	25 879
Portugal	52.1	3 142	Japan	30.8	7 265
Finland	**48.9**	**13 482**	Austria	30.6	6 355
Netherlands	46.0	5 659	Denmark	29.4	6 325

Source: OECD; Energy Balances 1993–1994.

6. Finland's carbon dioxide emissions from fossil fuels and peat (million tonnes)

	Total	Power plants	Industry	Transport
1980	54.0	..	..	..
1981	44.7	..	..	..
1982	42.8	..	..	..
1983	42.4	..	..	..
1984	43.4	..	..	..
1985	49.5	..	..	..
1986	48.1	..	..	..
1987	51.9	..	..	..
1988	51.6	..	..	..
1989	51.9	..	..	..
1990	53.1	..	..	..
1991	53.2	..	..	..
1992	51.4	29.5	8.5	13.4
1993	52.0	31.0	8.2	12.8
1994	58.4	36.3	8.6	13.1
1995	55.2	34.3	8.1	12.8
1996	60.0	..	..	..
2000	60.0*)	..	..	..
2005	65.0*)	..	..	..
2010	70.0*)	..	..	..

*) = Ministry of Trade and Industry forecast .. = data missing

Source: Ministry of Trade and Industry, Statistics Finland and Imatran Voima Oy.

7. Finland's sulphur emissions in 1980–95 (thousand tonnes of sulphur dioxide)

	Liquid fuels	Solid fuels	Forest industry	Metal industry	Oil refining	Other industry	Total
1980	248	91	104	42	61	38	584
1981	241	74	89	42	50	38	534
1982	232	62	65	42	45	38	484
1983	135	57	75	38	34	33	372
1984	125	73	71	33	34	32	368
1985	122	91	68	30	34	38	383
1986	100	79	56	33	31	32	331
1987	96	80	62	34	30	25	327
1988	82	70	53	35	32	31	303
1989	68	62	52	11	20	29	242
1990	75	87	48	7	20	21	258
1991	58	67	33	7	17	13	195
1992	44	47	17	10	9	14	141
1993	35	47	15	9	5	11	122
1994	35	48	11	9	4	11	118
1995	27	39	9	7	4	9	95
1996	..	..	..	..	..	..	100*)

.. = data missing *) = forecast

Source: Ministry of the Environment, Statistics Finland; ILMARI calculation model and Imatran Voima Oy.

8. Finland's nitrogen oxides emissions (thousand tonnes)

	Road transport	Other transport	Energy	Industry	Total
1980	136	43	98	18	295
1981	136	43	79	18	276
1982	137	43	73	18	271
1983	139	42	62	18	261
1984	140	42	57	18	257
1985	143	43	71	18	275
1986	147	42	70	18	277
1987	150	43	77	18	288
1988	155	43	77	18	293
1989	159	43	81	18	301
1990	158	43	82	17	300
1991	152	43	80	15	290
1992	146	43	76	20	283
1993	141	43	79	20	281
1994	137	43	82	21	283
1995	130	42	66	20	258
1996	..	..	..	..	260*)

.. = data missing *) = forecast

Source: Ministry of the Environment; Statistics Finland; ILMARI calculation model and Imatran Voima Oy.

10. Trends in public transport and private car use (million passenger kilometres)

	Total	Private cars	Public transport
1980	48 051	34 800	12 451
1981	49 300	35 900	12 600
1982	51 100	37 500	12 800
1983	53 000	39 300	12 900
1984	54 960	41 200	12 960
1985	57 445	43 700	12 945
1986	58 245	45 100	12 345
1987	59 669	46 000	12 869
1988	62 364	48 500	13 064
1989	63 779	49 900	13 079
1990	65 273	51 200	13 273
1991	64 196	50 600	12 696
1992	63 884	50 500	12 484
1993	62 882	49 700	12 282
1994	62 838	49 600	12 338
1995	63 522	50 060	12 562
1996	62 600	50 400	12 200

Source: Helsinki City Transport, National Board of Navigation, National Board of Aviation, Finnish National Road Administration and VR-Group Ltd.

11. Trends in road traffic emissions (thousand tonnes)

	Carbon monoxides	Hydrocarbons	Nitrogen oxides	Carbon oxide	Particles
1980	386.2	47.0	135.7	7 645.4	9.3
1981	382.9	47.7	135.7	7 447.9	9.5
1982	382.7	48.8	137.3	7 930.0	9.8
1983	382.6	50.0	138.5	8 203.1	10.1
1984	384.3	51.4	140.4	8 453.6	10.4
1985	382.3	52.6	143.0	8 851.8	10.7
1986	383.7	54.3	146.6	9 459.7	11.2
1987	390.3	56.6	149.6	9 929.8	11.4
1988	400.0	59.5	154.7	10 334.6	11.7
1989	410.2	61.7	159.1	10 985.0	11.7
1990	405.4	61.4	157.6	11 179.0	11.6
1991	373.3	58.7	151.5	10 858.6	11.4
1992	343.6	55.8	144.6	10 834.7	10.8
1993	329.8	54.0	140.4	10 196.5	10.3
1994	311.4	51.9	135.0	10 535.9	8.5
1995	304.9	50.7	131.8	10 391.7	8.0
1996*)	295.5	49.0	127.0	10 300.8	7.6
1997*)	282.2	47.3	121.9	10 640.3	7.1
1998*)	269.5	45.1	116.5	10 753.5	6.8
1999*)	258.8	42.9	111.2	10 993.8	6.5
2000*)	245.4	40.5	105.3	11 180.2	6.1

*) = forecast

Source: Technical Research Centre of Finland; LIISA calculation model.

12. Unleaded petrol sales as a proportion of motor petrol sales 1996

	Per cent
Sweden	100
Finland	**100**
Germany	97
Norway	93
Netherlands	92
Switzerland	88
Denmark	81
Belgium	74
Great Britain	68
France	56
Italy	45
Spain	34

Source: The Finnish Petroleum Federation.

13. Petrol (95E) consumer prices 19 May 1997 (FIM/litre)

	Bensiini 95E			Diesel		
	Tax-free price	Taxes	Consumer price	Tax-free price	Taxes	Consumer price
Luxembourg	1.39	2.42	3.81	1.25	1.87	3.12
Spain	1.40	2.65	4.05	1.25	1.96	3.21
Greece	1.32	2.73	4.05	1.06	1.92	2.98
Portugal	1.38	3.37	4.75	1.36	2.01	3.37
Ireland	1.60	3.21	4.81	1.70	2.86	4.56
Germany	1.34	3.53	4.87	1.27	2.30	3.57
Austria	1.73	3.22	4.95	1.59	2.32	3.91
Denmark	1.39	3.57	4.96	1.28	2.54	3.82
Belgium	1.39	3.83	5.22	1.40	2.32	3.72
France	1.10	4.22	5.32	1.08	2.71	3.79
Italy	1.53	3.99	5.52	1.35	2.96	4.31
Finland	1.42	4.12	5.54	1.38	2.32	3.70
France	1.16	4.44	5.60	1.21	4.45	5.66
Sweden	1.48	4.15	5.63	1.51	3.08	4.59
Netherlands	1.52	4.17	5.69	1.40	2.55	3.95
Norway	1.53	4.61	6.14	1.74	3.70	5.44

Source: EU/Oil Petrolier and ÖKL – The Finnish Petroleum Federation.

14. Forest growth and total drain (million cubic metres)

	Growth	Total drain
1980	68.4	58.8
1981	68.4	56.1
1982	68.4	52.9
1983	68.4	50.6
1984	68.4	52.6
1985	77.1	55.0
1986	77.1	49.6
1987	77.1	54.1
1988	77.1	57.1
1989	75.4	58.7
1990	75.4	55.0
1991	75.4	44.6
1992	75.4	50.8
1993	75.4	53.7
1994	75.4	61.5
1995	75.4	63.6
1996	75.4	56.9

Source: Finnish Forest Research Institute.

15. Forests annually fertilised and drained (hectares)

	Fertilised	Improvement	Improvement drainage
1980	87 226	113 400	34 500
1981	91 832	99 800	30 600
1982	109 758	84 000	31 700
1983	89 667	84 600	30 700
1984	79 514	77 500	40 500
1985	84 353	70 000	47 300
1986	86 661	67 200	42 900
1987	87 118	60 500	46 800
1988	79 147	69 400	39 800
1989	46 798	52 500	56 400
1990	47 655	41 100	71 600
1991	11 239	36 300	63 600
1992	5 026	34 500	73 600
1993	4 076	25 800	79 700
1994	6 003	16 900	82 000
1995	8 534	15 300	78 200

Source: Finnish Forest Research Institute; Yearbook of Forest Statistics.

16. Percentage of coniferous trees showing needle shedding in excess of 25 % in European countries in 1995

Czech Republic	60.7	Belium	21.0
Poland	54.5	Italy	19.4
Slovakia	52.0	Hungary	18.7
Netherlands	45.4	Germany	18.3
Belorussia	43.9	Spain	18.1
Bulgaria	41.4	Romania	15.2
Denmark	34.8	Sweden	14.5
Slovenia	33.6	Estonia	14.2
Lithuania	26.6	Finland	13.7
Ireland	26.3	Greece	13.6
Ukraine	25.7	Great Britain	13.0
Norway	24.0	France	9.2
Switzerland	23.2	Portugal	6.6
Latvia	23.0	Austria	6.6

Source: UN European Economic Commission; Forest Condition in Europe, Results of the 1995 Survey.

17. Use of fertilizers in agriculture (kg per cultivated hectare of field)

Year of fertilisation July 1 – June 30	Nitrogen	Phosphorus
1979/80	83.3	27.9
1980/81	82.4	27.8
1981/82	78.7	26.8
1982/83	91.4	29.9
1983/84	90.7	30.9
1984/85	88.9	30.8
1985/86	90.0	30.2
1986/87	94.4	31.0
1987/88	98.2	32.0
1988/89	100.3	29.7
1989/90	111.5	30.7
1990/91	109.4	26.3
1991/92	92.8	19.9
1992/93	94.3	19.4
1993/94	94.1	19.0
1994/95	101.6	20.0
1995/96	92.3	16.1

Source: Ministry of Forestry and Agriculture.

19. Nutrient burden in Finland 1995 (tonnes)

	Phosphorus	Nitrogen
Agriculture	3 300	32 900
Industry	407	5 433
Municipalities	660	17 270
Deposit	400	6 940
Other human-originated	427	2 969
Natural wash-off	1 800	45 000
Total	**6 994**	**110 512**

Source: Finnish Environment Institute.

20. State of conservation programmes as at 1 January 1997 (hectares of land area)

	Total land area	Founded	Not founded on State land	Not founded on private land
National and nature reserves	831 900	830 600	4 230	1 310
Herb-rich woodland protection programme	5 200	2 100	1 100	2 000
Mire protection programme	588 000	410 600	100 600	76 800
Shore protection programme	145 500	4 300	74 600	66 600
Bird sanctuary protection programme	83 000	4 800	3 600	74 600
Old-growth forests protection programme	344 100	9 400	313 500	21 200

Source: Ministry of the Environment.

Finland's Natural Resources and the Environment 1997

Finland's Natural Resources and the Environment 1997 is a review of the state of Finland's natural resources and the environment. It presents the salient principles of economic and environmental interaction. It also reviews trends in the main sectors of the economy as they affect the environment. These sectors are industry, energy, transport, natural resources and environmental protection. Finally, a list is given of the main conventions on the protection of natural resources and the environment to which Finland is a signatory.

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ISSN 0784-8455
= Environment
ISSN 1238-0582
ISBN 951-727-365-7

9 789517 273657